

POWER GENERAL

A Division of **Nidec** Corporation
152 Will Drive, Canton, MA 02021

Power General is pleased to provide you with our latest full line catalog of switching AC-DC power supplies and DC-DC converters. Our current offering reflects continued improvement toward Power General's goal of offering higher value products to our customers.

We feel Power General offers several key benefits to its customers:

Extremely high reliability. We offer robust products engineered with considerably higher performance margins (confirmed through extensive benchmarking) than competitive products. The result is that our customers enjoy greater reliability in their products.

Higher quality products. All of our products are produced under strict Statistical Process Controls to assure that product is built consistently to high manufacturing standards. Our facility has been steadily expanding its TQC program for several years; our process yields are in the PPM range with continuous improvement always our main objective. Certification to ISO 9001 should further assure our customers of our process consistency and commitment to quality.

A company-wide focus on customer service. We are a domestic manufacturer. Our products are assembled in Massachusetts in a Just-In-Time environment. We measure our delivery performance against the customer request date. We produce daily shipments on a major portion of our sales. We have a bias for action.

A commitment to continuous improvement. We invest significant resources in training our employees—truly our only appreciable asset. That investment provides the fuel to constantly strive for a better level of performance throughout our organization.

We hope this catalog contains products that suit your needs. If it doesn't, please call us. We would be happy to listen to your specific requirements and provide you with Power General solutions.



Charlie Aubee
Vice President and General Manager

POWER GENERAL

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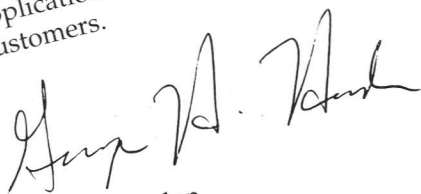
POWER
GENERAL
Nidec Corporation
Canton, MA 02021

This catalog offers a comprehensive selection of 20W to 150W universal input switching power supplies. Our revamped dc-dc converter product line now spans the power range of 1W to 150W and includes several new high-density designs.

Our product design strategy sticks to two basic rules: Listen to customers. Design for reliability.

We implement these fundamentals with visits to customers and a team approach to design within the factory.

We are committed to introducing innovative, robust standard products that serve the performance-conscious marketplace. That strong foundation of standard products gives us a solid platform for design of application-specific power supplies for our customers.



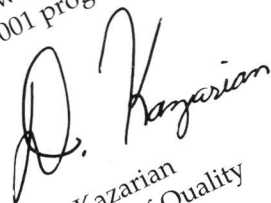
George Harlan
Director of Engineering

Power General pursues a continuous improvement approach to quality, involving every individual in the company.

We use cross-functional Quality Improvement Teams, each one championed by a plant staff member. The purpose of these teams is to conduct statistical training, identify problems, initiate corrective action and take steps to assure prevention. All activities are driven by a desire to improve customer satisfaction with Power General's products and service.

We have already made significant and measurable improvements in many areas and we have targeted other areas for similar corrective action. We believe that improvement is a continuing process, without limit.

Our activities and capabilities have brought us to the point of measuring faults in a few parts per million and we continue to strive for further product and process improvements. As a measure of that ongoing work, we are currently engaged in a company-wide ISO 9001 program.



Dan Kazarian
Director of Quality

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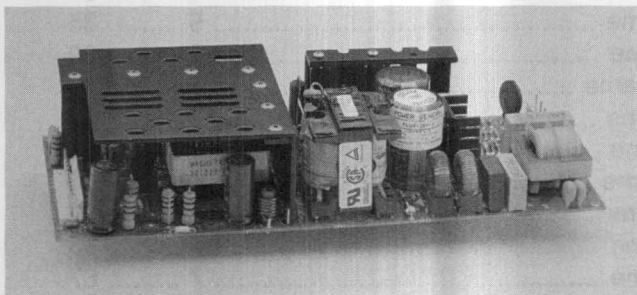
NEW!

FROM

POWER GENERAL

A Division of **Nidec** Corporation

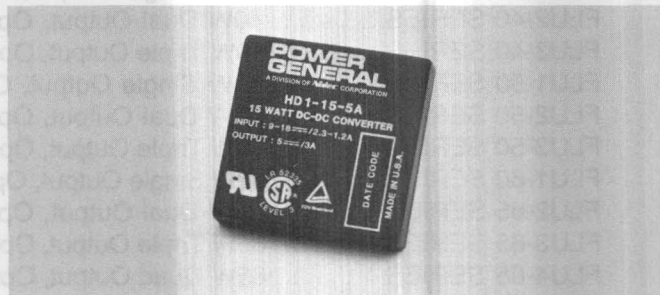
150-WATT, QUAD OUTPUT SWITCHING POWER SUPPLIES



FLU4-150

- 90-265 VAC INPUT RANGE
- INTERNATIONAL SAFETY APPROVALS
- 0% MINIMUM LOAD ON ALL OUTPUTS
- 2-YEAR WARRANTY
- **MIN. 165,000-HOUR MTBF**

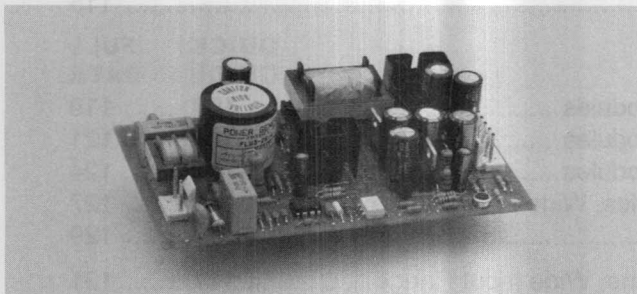
15-WATT & 25-WATT HIGH-DENSITY CONVERTERS



HD1-15 * HD3-25

- WIDE INPUT VOLTAGE RANGES
- 15W SINGLE OUTPUT
- 25W TRIPLE OUTPUT
- INTERNATIONAL SAFETY STANDARDS
- **MIN. 300,000-HOUR MTBF**

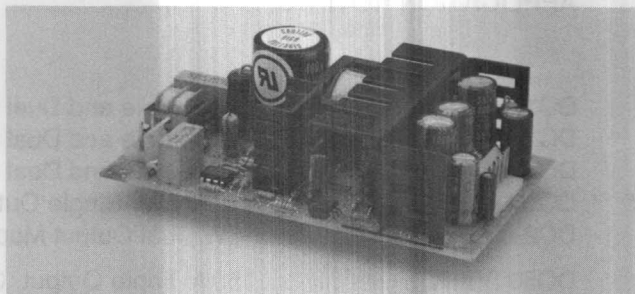
25W SINGLE & TRIPLE OUTPUT SWITCHING POWER SUPPLIES



FLU1-25 * FLU3-25

- 85-265 VAC INPUT RANGE
- INTERNATIONAL SAFETY STANDARDS
- VERY COMPACT PACKAGES
- BUILT-IN FCC/VDE CLASS B FILTER
- **MIN. 200,000-HOUR MTBF**

40W SWITCHING SUPPLIES WITH MEDICAL SAFETY



MDU1-40 * MDU2-40 * MDU3-40

- UL544 AND IEC601 APPROVALS
- 85-265 VAC INPUT VOLTAGE RANGE
- 40 WATTS CONTINUOUS OUTPUT
- 200 μ A MAX. LEAKAGE CURRENT
- **MIN. 205,000-HOUR MTBF**

PRODUCT UPDATE

Power General's ongoing dedication to design innovation and product improvement has produced many new power supplies that offer significant advantages in performance, size and reliability. The replacement guide below recommends conversion to these enhanced Power General products in new equipment designs.

Power General Product		Recommended for New Designs
125 Series	AC-DC 25W Single Output Module	SM1-25 Series
225 Series	AC-DC 25W Dual Output Module	SM2-25 Series
325 Series	AC-DC 25W Triple Output Module	SM3-25 Series
327 Series	AC-DC 25W Triple Output, Open-Frame	FLU3-25 Series
1040 Series	AC-DC 40W Single Output, Open-Frame	FLU1-40 Series
1050 Series	AC-DC 50W Single Output, Open-Frame	FLU1-50 Series
1060 Series	AC-DC 60W Single Output, Open-Frame	FLU1-60 Series
2040 Series	AC-DC 40W Dual Output, Open-Frame	FLU2-40 Series
2050 Series	AC-DC 50W Dual Output, Open-Frame	FLU2-50 Series
2060 Series	AC-DC 60W Dual Output, Open-Frame	FLU2-65 Series
3045 Series	AC-DC 40W Triple Output, Open-Frame	FLU3-40 Series
3050 Series	AC-DC 50W Triple Output, Open-Frame	FLU3-50 Series
3055 Series	AC-DC 50W Triple Output, Open-Frame	FLU3-50 Series
3060 Series	AC-DC 60W Triple Output, Open-Frame	FLU3-65 Series
3100 Series	AC-DC 100W Triple Output, Open-Frame	FLU3-100 Series
3110 Series	AC-DC 100W Triple Output, Open-Frame	FLU3-100 Series
4100 Series	AC-DC 100W Quad Output, Open-Frame	FLU4-100 Series
4110 Series	AC-DC 100W Quad Output, Open-Frame	FLU4-100 Series
4155 Series	AC-DC 150W Quad Output, Open-Frame	FLU4-150 Series
SP1-50 Series	AC-DC 50W Single Output, Open-Frame	FLU1-50 Series
SP3-40 Series	AC-DC 40W Triple Output, Open-Frame	FLU3-40 Series
SP3-65 Series	AC-DC 65W Triple Output, Open-Frame	FLU3-65 Series
SP4-65 Series	AC-DC 65W Quad Output, Open-Frame	FLU4-65 Series
400 Series	DC-DC 1W Single/Dual Output Module	DC1-1/DC2-1 Series
460 Series	DC-DC 2W Single/Dual Output Module	DC1-2/DC2-2 Series
500 Series	DC-DC 1W Single/Dual Output Module	DC1-1/DC2-1 Series
520 Series	DC-DC 1W Single Output Module	DC1-1 Series
530 Series	DC-DC 1W Dual Output Module	DC2-1 Series
540 Series	DC-DC 1W Single/Dual Output Module	DC1-1/DC2-1 Series
620 Series	DC-DC 6W Dual Output Module	DC2-6 Series
710 Series	DC-DC 5W Single Output Module	DCU1-5 Series
730 Series	DC-DC 25W Triple Output Module	HD3-25 Series
750 Series	DC-DC 15W Single Output Module	HD1-15 Series
800 Series	DC-DC 5W Single/Dual Output Module	DC1-5/DC2-5 Series
LP315 Series	DC-DC 25W Triple Output Module	HD3-25 Series

QUICK SELECTION GUIDE

—Switching Power Supplies—

OPEN-FRAME SINGLE OUTPUT MODELS

In Order of Output Power, Output Voltage

Model Number	Output Voltage		Max. Output Current (A)	Max. Output Power (W)	Package Size (Inches)	For Complete Data, See Page
	(V)	Tol.				
FLU1-25-1	5.0	±1.0%	5.0	25	2.75 x 5.0 x 1.2	23
FLU1-25-2	9.0	±1.0%	2.8	25	2.75 x 5.0 x 1.2	23
FLU1-25-3	12	±1.0%	2.1	25	2.75 x 5.0 x 1.2	23
FLU1-25-4	15	±1.0%	1.7	25	2.75 x 5.0 x 1.2	23
FLU1-25-5	24	±1.0%	1.0	25	2.75 x 5.0 x 1.2	23
FLU1-25-6	28	±1.0%	0.9	25	2.75 x 5.0 x 1.2	23
FLU1-40-1	5.0	±1.0%	8.0	40	3.0 x 5.0 x 1.5	31
FLU1-40-2	9.0	±1.0%	4.4	40	3.0 x 5.0 x 1.5	31
FLU1-40-3	12	±1.0%	3.3	40	3.0 x 5.0 x 1.5	31
FLU1-40-4	15	±1.0%	2.7	40	3.0 x 5.0 x 1.5	31
FLU1-40-5	24	±1.0%	1.7	40	3.0 x 5.0 x 1.5	31
FLU1-40-6	28	±1.0%	1.4	40	3.0 x 5.0 x 1.5	31
FLU1-50-1	5.0	±1.0%	10	50	3.0 x 5.0 x 1.75	43
FLU1-50-2	9.0	±1.0%	5.6	50	3.0 x 5.0 x 1.75	43
FLU1-50-3	12	±1.0%	4.2	50	3.0 x 5.0 x 1.75	43
FLU1-50-4	15	±1.0%	3.3	50	3.0 x 5.0 x 1.75	43
FLU1-50-5	24	±1.0%	2.1	50	3.0 x 5.0 x 1.75	43
FLU1-50-6	28	±1.0%	1.8	50	3.0 x 5.0 x 1.75	43
FLU1-60-1	5.0	±1.0%	12	60	4.0 x 5.0 x 1.7	55
FLU1-60-2	9.0	±1.0%	6.7	60	4.0 x 5.0 x 1.7	55
FLU1-60-3	12	±1.0%	5.0	60	4.0 x 5.0 x 1.7	55
FLU1-60-4	15	±1.0%	4.0	60	4.0 x 5.0 x 1.7	55
FLU1-60-5	24	±1.0%	2.5	60	4.0 x 5.0 x 1.7	55
FLU1-60-6	28	±1.0%	2.1	60	4.0 x 5.0 x 1.7	55
FLU1-100-1	5.0	±1.0%	20	100	4.0 x 8.0 x 2.2	71
FLU1-100-2	12	±1.0%	8.3	100	4.0 x 8.0 x 2.2	71
FLU1-100-3	15	±1.0%	6.7	100	4.0 x 8.0 x 2.2	71
FLU1-100-4	24	±1.0%	4.2	100	4.0 x 8.0 x 2.2	71
FLU1-100-5	28	±1.0%	3.6	100	4.0 x 8.0 x 2.2	71

UL544-APPROVED, OPEN-FRAME, SINGLE OUTPUT MODELS

In Order of Output Voltage

Model Number	Output Voltage		Max. Output Current (A)	Max. Output Power (W)	Package Size (Inches)	For Complete Data, See Page
	(V)	Tol.				
MDU1-40-1	5.0	±1.0%	8.0	40	3.0 x 5.0 x 1.5	87
MDU1-40-2	9.0	±1.0%	4.4	40	3.0 x 5.0 x 1.5	87
MDU1-40-3	12	±1.0%	3.3	40	3.0 x 5.0 x 1.5	87
MDU1-40-4	15	±1.0%	2.7	40	3.0 x 5.0 x 1.5	87
MDU1-40-5	24	±1.0%	1.7	40	3.0 x 5.0 x 1.5	87
MDU1-40-6	28	±1.0%	1.4	40	3.0 x 5.0 x 1.5	87

QUICK SELECTION GUIDE

—Switching Power Supplies—

ENCAPSULATED SINGLE OUTPUT MODELS

In Order of Output Voltage

Model Number	Output Voltage		Max. Output Current (A)	Max. Output Power (W)	Package Size (Inches)	For Complete Data, See Page
	(V)	Tol.				
SM1-25-1DCM	5.0	±1.0%	5.0	25	2.8 x 4.7 x 1.4	103
SM1-25-1DPM	5.0	±1.0%	5.0	25	2.5 x 3.5 x 1.4	103
SM1-25-2DCM	9.0	±1.0%	2.8	25	2.8 x 4.7 x 1.4	103
SM1-25-2DPM	9.0	±1.0%	2.8	25	2.5 x 3.5 x 1.4	103
SM1-25-3DCM	12	±1.0%	2.1	25	2.8 x 4.7 x 1.4	103
SM1-25-3DPM	12	±1.0%	2.1	25	2.5 x 3.5 x 1.4	103
SM1-25-4DCM	15	±1.0%	1.7	25	2.8 x 4.7 x 1.4	103
SM1-25-4DPM	15	±1.0%	1.7	25	2.5 x 3.5 x 1.4	103
SM1-25-5DCM	24	±1.0%	1.0	25	2.8 x 4.7 x 1.4	103
SM1-25-5DPM	24	±1.0%	1.0	25	2.5 x 3.5 x 1.4	103
SM1-25-6DCM	28	±1.0%	0.9	25	2.8 x 4.7 x 1.4	103
SM1-25-6DPM	28	±1.0%	0.9	25	2.5 x 3.5 x 1.4	103

OPEN-FRAME DUAL OUTPUT MODELS

In Order of Output Power, Primary Output Voltage

Model Number	Output 1			Output 2			Max. Output Power (W)	Package Size (Inches)	For Complete Data, See Page
	Voltage (V)	Voltage Tol.	Max. Current (A)	Voltage (V)	Voltage Tol.	Max. Current (A)			
FLU2-20-1	+5.0	±1.0%	3.0	+12	±5.0%	1.0	20	3.0 x 5.0 x 1.2	19
FLU2-20-2	+5.0	±1.0%	3.0	+15	±5.0%	0.8	20	3.0 x 5.0 x 1.2	19
FLU2-20-3	+5.0	±1.0%	3.0	+24	±5.0%	0.5	20	3.0 x 5.0 x 1.2	19
FLU2-40-1	+5.0	±1.0%	5.0	+12	±5.0%	3.0	40	3.0 x 5.0 x 1.5	35
FLU2-40-2	+5.0	±1.0%	5.0	+15	±5.0%	2.0	40	3.0 x 5.0 x 1.5	35
FLU2-40-3	+5.0	±1.0%	5.0	+24	±5.0%	1.5	40	3.0 x 5.0 x 1.5	35
FLU2-40-4	+5.0	±1.0%	5.0	+28	±5.0%	1.0	40	3.0 x 5.0 x 1.5	35
FLU2-40-5	5.0	±1.0%	6.0	5.0	±3.0%	2.0	40	3.0 x 5.0 x 1.5	35
FLU2-40-6	12	±1.0%	3.0	12	±3.0%	2.0	40	3.0 x 5.0 x 1.5	35
FLU2-40-7	15	±1.0%	2.5	15	±3.0%	2.0	40	3.0 x 5.0 x 1.5	35
FLU2-50-1	+5.0	±1.0%	6.0	+12	±5.0%	3.0	50	4.0 x 5.0 x 1.7	47
FLU2-50-2	+5.0	±1.0%	6.0	+24	±5.0%	1.5	50	4.0 x 5.0 x 1.7	47
FLU2-65-1	+5.0	±1.0%	8.5	+12	±5.0%	3.0	65	4.0 x 6.5 x 1.85	59
FLU2-65-2	+5.0	±1.0%	5.0	+12	±5.0%	5.0	65	4.0 x 6.5 x 1.85	59
FLU2-65-3	+5.0	±1.0%	8.5	+24	±5.0%	2.5	65	4.0 x 6.5 x 1.85	59
FLU2-65-4	5.0	±1.0%	11	5.0	±3.0%	2.0	65	4.0 x 7.25 x 2.0	59
FLU2-65-5	5.0	±1.0%	11	12	±3.0%	2.0	65	4.0 x 7.25 x 2.0	59

UL544-APPROVED, OPEN-FRAME, DUAL OUTPUT MODELS

In Order of Output Voltage

Model Number	Output 1			Output 2			Max. Output Power (W)	Package Size (Inches)	For Complete Data, See Page
	Voltage (V)	Voltage Tol.	Max. Current (A)	Voltage (V)	Voltage Tol.	Max. Current (A)			
MDU2-40-1	+5.0	±1.0%	5.0	+12	±5.0%	3.0	40	3.0 x 5.0 x 1.5	91
MDU2-40-2	+5.0	±1.0%	5.0	+15	±5.0%	2.0	40	3.0 x 5.0 x 1.5	91
MDU2-40-3	+5.0	±1.0%	5.0	+24	±5.0%	1.5	40	3.0 x 5.0 x 1.5	91
MDU2-40-4	+5.0	±1.0%	5.0	+28	±5.0%	1.0	40	3.0 x 5.0 x 1.5	91

QUICK SELECTION GUIDE

—Switching Power Supplies—

ENCAPSULATED DUAL OUTPUT MODELS

In Order of Output Voltage

Model Number	Output 1			Output 2			Max. Output Power (W)	Package Size (Inches)	For Complete Data, See Page
	Voltage (V)	Voltage Tol.	Max. Current (A)	Voltage (V)	Voltage Tol.	Max. Current (A)			
SM2-25-1DCM	+5.0	±1.0%	4.0	-5.0	±4.0%	1.6	25	2.8 x 4.7 x 1.4	103
SM2-25-1DPM	+5.0	±1.0%	4.0	-5.0	±4.0%	1.6	25	2.75 x 4.1 x 1.4	103
SM2-25-2DCM	+12	±2.0%	1.8	-12	±2.0%	1.8	25	2.8 x 4.7 x 1.4	103
SM2-25-2DPM	+12	±2.0%	1.8	-12	±2.0%	1.8	25	2.75 x 4.1 x 1.4	103
SM2-25-3DCM	+15	±2.0%	1.6	-15	±2.0%	1.6	25	2.8 x 4.7 x 1.4	103
SM2-25-3DPM	+15	±2.0%	1.6	-15	±2.0%	1.6	25	2.75 x 4.1 x 1.4	103

OPEN-FRAME TRIPLE OUTPUT MODELS

In Order of Output Power

Model Number	Output 1		Output 2		Output 3		Max. Output Power (W)	Package Size (Inches)	For Complete Data, See Page
	Voltage (V)	Max. Current (A)	Voltage (V)	Max. Current (A)	Voltage (V)	Max. Current (A)			
FLU3-25-1	5.0	2.0	+12	1.5	-12	0.2	25	3.0 x 5.0 x 1.2	27
FLU3-25-2	5.0	2.0	+12	1.5	-5.0	0.5	25	3.0 x 5.0 x 1.2	27
FLU3-25-3	5.0	2.0	+15	1.2	-15	0.2	25	3.0 x 5.0 x 1.2	27
FLU3-25-4	5.0	2.0	+24	0.75	-12	0.2	25	3.0 x 5.0 x 1.2	27
FLU3-40-1	5.0	5.0	+12	3.0	-12	1.0	40	3.0 x 5.0 x 1.5	39
FLU3-40-2	5.0	5.0	+12	3.0	-5.0	1.0	40	3.0 x 5.0 x 1.5	39
FLU3-40-3	5.0	5.0	+15	2.0	-15	1.0	40	3.0 x 5.0 x 1.5	39
FLU3-40-4	5.0	5.0	+24	1.5	-12	1.0	40	3.0 x 5.0 x 1.5	39
FLU3-40-5	5.0	6.0	12	0.5	12	0.5	40	3.0 x 5.0 x 1.5	39
FLU3-40-6	5.0	6.0	15	0.5	15	0.5	40	3.0 x 5.0 x 1.5	39
FLU3-50-1	5.0	6.0	+12	3.0	-12	0.5	50	4.0 x 5.0 x 1.7	51
FLU3-50-2	5.0	6.0	+12	3.0	-5.0	0.5	50	4.0 x 5.0 x 1.7	51
FLU3-50-3	5.0	6.0	+15	2.0	-15	0.5	50	4.0 x 5.0 x 1.7	51
FLU3-50-4	5.0	9.0	+12	0.6	-12	0.6	50	4.0 x 5.0 x 1.7	51
FLU3-50-5	5.0	6.0	+15	0.6	-15	0.6	50	4.0 x 5.0 x 1.7	51
FLU3-65-1	5.0	6.0	+12	3.0	5.0	2.0	65	4.0 x 7.25 x 2.0	63
FLU3-65-2	5.0	6.0	+12	3.0	12	1.0	65	4.0 x 7.25 x 2.0	63
FLU3-65-3	5.0	6.0	+24	1.5	5.0	2.0	65	4.0 x 7.25 x 2.0	63
FLU3-65-4	5.0	6.0	+24	1.5	12	1.0	65	4.0 x 7.25 x 2.0	63
FLU3-65-5	5.0	6.0	+12	3.0	-12	3.0	65	4.0 x 7.25 x 2.0	63
FLU3-65-6	5.0	6.0	+15	2.0	-15	2.0	65	4.0 x 7.25 x 2.0	63
FLU3-65-7	5.0	10	+12	1.5	-12	1.5	65	4.0 x 7.25 x 2.0	63
FLU3-65-8	5.0	10	5.0	2.0	12	0.5	65	4.0 x 7.25 x 2.0	63
FLU3-65-9	5.0	10	+15	1.5	-15	1.5	65	4.0 x 7.25 x 2.0	63
FLU3-65-10	5.0	10	5.0	2.0	12	0.5	65	4.0 x 7.25 x 2.0	63
FLU3-100-1	5.0	15	+12	8.0	-5.0	1.0	100	4.0 x 8.0 x 2.2	75
FLU3-100-2	5.0	15	+12	8.0	-12	1.0	100	4.0 x 8.0 x 2.2	75
FLU3-100-3	5.0	15	+24	4.0	-5.0	1.0	100	4.0 x 8.0 x 2.2	75
FLU3-100-4	5.0	15	+24	4.0	-12	1.0	100	4.0 x 8.0 x 2.2	75
FLU3-100-5	5.0	15	+12	3.0	-12	3.0	100	4.0 x 8.0 x 2.2	75
FLU3-100-6	5.0	15	+15	2.2	-15	2.2	100	4.0 x 8.0 x 2.2	75

QUICK SELECTION GUIDE

—Switching Power Supplies—

UL544-APPROVED, OPEN-FRAME, TRIPLE OUTPUT MODELS

In Order of Output Power

Model Number	Output 1		Output 2		Output 3		Max. Output Power (W)	Package Size (Inches)	For Complete Data, See Page
	Voltage (V)	Max. Current (A)	Voltage (V)	Max. Current (A)	Voltage (V)	Max. Current (A)			
MDU3-40-1	5.0	5.0	+12	3.0	-12	1.0	40	3.0 x 5.0 x 1.5	95
MDU3-40-2	5.0	5.0	+12	3.0	-5.0	1.0	40	3.0 x 5.0 x 1.5	95
MDU3-40-3	5.0	5.0	+15	2.0	-15	1.0	40	3.0 x 5.0 x 1.5	95
MDU3-40-4	5.0	5.0	+24	1.5	-12	1.0	40	3.0 x 5.0 x 1.5	95
MDU3-100-1	5.0	15	+12	8.0	-5.0	1.0	100	4.0 x 8.0 x 2.2	99
MDU3-100-2	5.0	15	+12	8.0	-12	1.0	100	4.0 x 8.0 x 2.2	99
MDU3-100-3	5.0	15	+24	4.0	-5.0	1.0	100	4.0 x 8.0 x 2.2	99
MDU3-100-4	5.0	15	+24	4.0	-12	1.0	100	4.0 x 8.0 x 2.2	99

ENCAPSULATED TRIPLE OUTPUT MODELS

In Order of Output Voltage

Model Number	Output 1		Output 2		Output 3		Max. Output Power (W)	Package Size (Inches)	For Complete Data, See Page
	Voltage (V)	Max. Current (A)	Voltage (V)	Max. Current (A)	Voltage (V)	Max. Current (A)			
SM3-25-1DCM	5.0	4.0	+12	0.3	-12	0.3	25	2.8 x 4.7 x 1.4	103
SM3-25-1DPM	5.0	4.0	+12	0.3	-12	0.3	25	2.75 x 4.1 x 1.4	103
SM3-25-2DCM	5.0	4.0	+15	0.3	-15	0.3	25	2.8 x 4.7 x 1.4	103
SM3-25-2DPM	5.0	4.0	+15	0.3	-15	0.3	25	2.75 x 4.1 x 1.4	103

OPEN-FRAME QUAD OUTPUT MODELS

In Order of Output Power

Model Number	Output 1		Output 2		Output 3		Output 4		Max. Output Power (W)	Package Size (Inches)	Full Data, See Page
	Voltage (V)	Max. Current (A)	Voltage (V)	Max. Current (A)	Voltage (V)	Max. Current (A)	Voltage (V)	Max. Current (A)			
FLU4-65-1	5.0	6.0	+12	5.0	-12	1.0	-5.0	0.25	65	4.0 x 7.25 x 2.0	67
FLU4-65-2	5.0	6.0	+24	2.5	-12	1.0	-5.0	0.25	65	4.0 x 7.25 x 2.0	67
FLU4-65-3	5.0	6.0	+12	2.5	-12	2.5	5.0	2.0	65	4.0 x 7.25 x 2.0	67
FLU4-65-4	5.0	6.0	+15	2.0	-15	2.0	5.0	2.0	65	4.0 x 7.25 x 2.0	67
FLU4-65-5	5.0	6.0	+12	2.5	-12	2.5	24	1.0	65	4.0 x 7.25 x 2.0	67
FLU4-65-6	5.0	10	+12	1.5	-12	1.5	5.2	1.5	65	4.0 x 7.25 x 2.0	67
FLU4-65-7	5.0	10	+15	1.5	-15	1.5	5.2	1.5	65	4.0 x 7.25 x 2.0	67
FLU4-100-1	5.0	15	+12	7.5	-12	0.8	-5.0	0.25	100	4.0 x 8.0 x 2.2	79
FLU4-100-2	5.0	15	+24	3.5	-12	0.8	-5.0	0.25	100	4.0 x 8.0 x 2.2	79
FLU4-100-3	5.0	15	+12	3.0	-12	3.0	5.0	2.0	100	4.0 x 8.0 x 2.2	79
FLU4-100-4	5.0	15	+15	2.2	-15	2.2	5.0	2.2	100	4.0 x 8.0 x 2.2	79
FLU4-100-5	5.0	15	+12	3.0	-12	3.0	24	2.0	100	4.0 x 8.0 x 2.2	79
FLU4-100-6	5.0	15	+15	2.2	-15	2.2	24	2.0	100	4.0 x 8.0 x 2.2	79
FLU4-100-7	5.0	18	12	0.8	12	0.8	5.2	3.0	100	4.0 x 8.0 x 2.2	79
FLU4-100-8	5.0	18	15	0.8	15	0.8	5.2	3.0	100	4.0 x 8.0 x 2.2	79
FLU4-150-1	5.0	15	12	4.0	12	4.0	5.0	4.0	150	4.0 x 9.5 x 2.0	83
FLU4-150-2	5.0	15	12	4.0	12	4.0	12	6.0	150	4.0 x 9.5 x 2.0	83
FLU4-150-3	5.0	15	12	4.0	12	4.0	15	4.0	150	4.0 x 9.5 x 2.0	83
FLU4-150-4	5.0	15	12	4.0	12	4.0	24	3.0	150	4.0 x 9.5 x 2.0	83
FLU4-150-5	5.0	15	15	3.0	15	3.0	5.0	4.0	150	4.0 x 9.5 x 2.0	83

THEORY OF OPERATION — Switching Power Supplies

Regulated switching power supplies have been available for many years, but recent developments in semiconductor switching components and product design innovations have made them cost-effective for a broad range of applications. As demand for smaller, lighter, more efficient power sources continues to grow, switchers increasingly replace older linear technology.

PARAMETER	SWITCHER	LINEAR
Line/Load Regulation	$\pm 0.1\%/\pm 0.2\%$	$\pm 0.1\%/\pm 0.1\%$
Output Noise & Ripple	100 mV _{pp}	3 mV _{pp}
Efficiency	70-80%	35-45%
Input Voltage Range	+20%	+ 10%
Transient Response Time	300 ms	50 ms
Hold-Up Time	16-32 ms	3 ms
Size (Power Density)	1-3 W/in ³	0.4W/in ³
Weight	50 W/lb	10 W/lb

TABLE 1. Switching vs. Linear Power Supplies

Table 1 gives a comparison of typical linear and switching power supply specifications. While linear supplies have better regulation, lower peak-to-peak output noise and faster transient response, the two technologies are comparable in other important areas. New switchers have inherently higher efficiencies, due to the use of fewer dissipative components. The input voltage range is much wider and has no effect on efficiency. Power density is much higher, making compact, lightweight, mechanical designs possible. Finally, hold-up time, an important specification for computer applications, is much longer.

At Power General, three basic design techniques are used in the switching power supply product line—the flyback converter, the forward converter, and the half-bridge converter.

AC/DC THEORY OF OPERATIONS

AC Input Voltage

There are four ac input voltage configurations to choose from when selecting a power supply:

Factory Wired

The power supply manufacturer configures the input to accept 110 VAC or 220 VAC.

Manual Select

The customer can change the input configuration to 110 VAC or 220 VAC by changing jumpers or selecting input pins.

Autoranging

The unit itself determines whether the input is in the 110 VAC or 220 VAC range and adjusts to accept the appropriate range.

Universal Input

The unit will accept any voltage between 85 VAC and 265 VAC as a single range.

FLYBACK CONVERTER

The flyback configuration is the most popular topology for low-power designs. Highly reliable and adaptable to international safety standards, the flyback design has found wide use in applications requiring 100 watts or less of output power. The flyback converter, shown in Figure 1, operates as follows: When switching transistor Q_1 is ON, energy is accumulated in the primary circuit of transformer T_1 . The opposite polarity arrangement of the transformer reverse biases diode D_1 , preventing any energy transfer to the output circuit.

During the time that Q_1 is OFF, the “flyback” period, the transformer polarity reverses. This forward biases D_1 and allows the energy stored in the transformer to be discharged into the output circuit. Unlike other switching supply designs, the primary and secondary windings do not conduct at the same time.

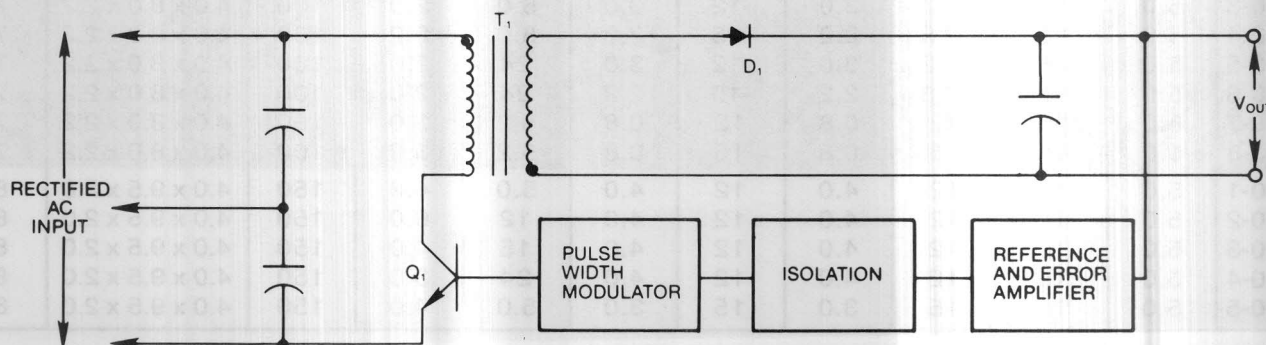


Figure 1: Flyback Converter

THEORY OF OPERATION — Switching Power Supplies

Output regulation is provided by a pulse-width modulation control loop. This circuit keeps the output at a constant value by controlling the ON/OFF time of the switching transistor Q_1 . The longer the ON time of Q_1 , the more energy is stored in the primary of T_1 and, consequently, the higher the output voltage.

The flyback converter's energy transfer delay causes longer transient response times and higher output ripple and noise levels. However, the lower component count increases reliability and decreases cost and size. Because of its smaller size and lower cost, the flyback converter is the most popular design technique over its cost-effective power range of 25 to 100 watts.

FORWARD CONVERTER

The forward converter is another popular switching power supply design topology. At first glance, the forward converter appears to be the same as a flyback design; however, as Figure 2 shows, the primary and secondary windings of T_1 are of the same polarity and the circuit includes an inductive storage element (L_1).

Circuit operation is as follows: When the switching transistor Q_1 is turned ON, energy is stored in the primary windings of T_1 . Because of the polarity configuration of T_1 , this energy is forward transferred to the secondary circuit and then stored in the output inductor L_1 through the forward-biased diode CR_1 .

When Q_1 turns OFF, the polarity of T_1 reverses, reverse biasing CR_1 and forward biasing the flywheel diode CR_2 . Since the energy field of L_1 cannot collapse instantaneously, current continues to flow in the output loop through CR_2 .

Output regulation is provided by a pulse-width modulation control loop. The longer Q_1 is ON, the higher is the average secondary voltage and, consequently, the higher the output voltage.

The forward converter exhibits lower output ripple and noise and faster transient response times than the flyback design, primarily due to current flowing in the output inductor during both halves of the switching cycle. The forward converter is adaptable to international safety standards and has a cost-effective power range of 80 to 200 watts.

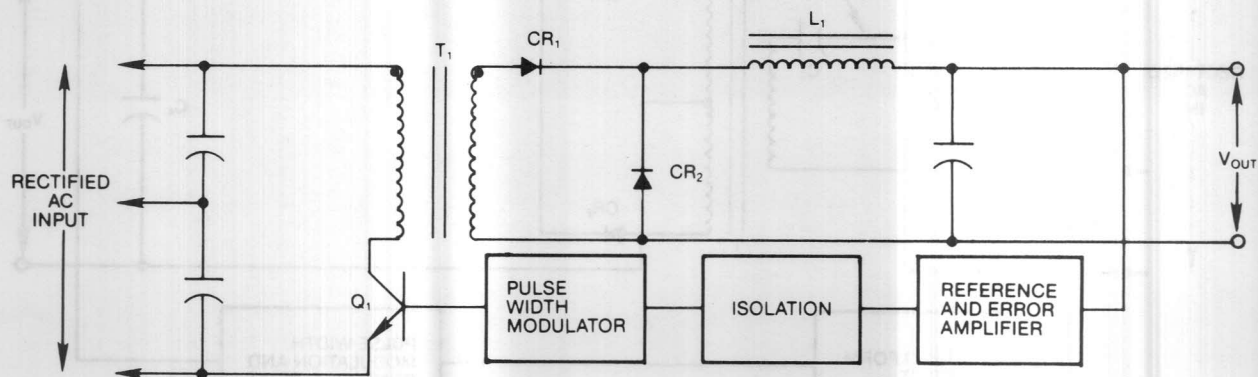


Figure 2: Forward Converter

THEORY OF OPERATION — Switching Power Supplies

HALF-BRIDGE CONVERTER

The half-bridge forward converter shown in Figure 3 is a well-established design technique. This design works in essentially the same way as the forward converter.

When transistor Q_1 is switched ON, a positive pulse is generated across the primary circuit of T_1 . When Q_1 turns OFF, Q_2 turns ON, the polarity of T_1 reverses and a negative pulse is generated. The switching action of Q_1 and Q_2 generates a square wave which is stepped down by T_1 , rectified by CR_1 and CR_2 , and filtered by L_1 and C_4 .

The half-bridge configuration features very good output ripple and noise characteristics and excellent transient response time. Because of the increased component costs, there has been a shift from half-bridge designs to flyback converters for low-power applications.

EMI/RFI

Electromagnetic and radio frequency interference refers to noise generated by the switching action of electronic components or subassemblies, in this case a switching power supply. This noise consists of two basic types—conducted and radiated—and is governed by Federal Communications Commission (FCC) and Verband Deutscher Electronotechniker (VDE) regu-

lations. These regulations are covered under FCC Docket 20780 Part 15 and VDE-0875N, -0871A, and -0871B.

Conducted EMI/RFI is noise reflected back onto the power line through the component's input and/or output terminals. The FCC and VDE define two levels (class or level A and B) of allowable emissions for computing devices. A computing device is defined as any electronic device or system that generates timing or pulsed signals in excess of 10,000 pulses (cycles) per second. This definition also covers input/output devices such as terminals, printers and disk drives that are intended for connection to a computer.

Differences in Class A and B conducted emissions requirements follow:

CLASS A

FCC—The FCC defines Class A computing devices as those marketed for use in a commercial, industrial, or business environment. Verification is required, but test data is maintained by the manufacturer. The specified frequency range for Class A is 450 kHz to 30 MHz.

VDE—VDE does not specify end market criteria, rather it defines licensing regulations. To meet VDE Level A requirements, a manufacturer has to apply to the FTZ (equivalent to the FCC) for a special operating license. The specified frequency range for Level A is 150 kHz to 30 MHz.

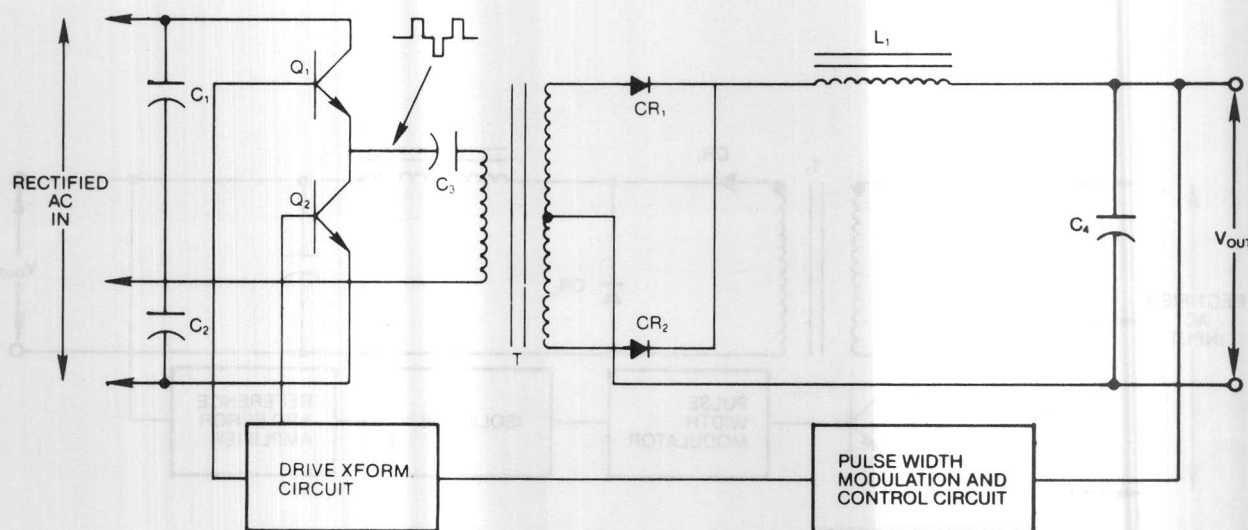


Figure 3: Half-Bridge Forward Converter

THEORY OF OPERATION — Switching Power Supplies

CLASS B

FCC—Class B devices are defined as those marketed for use in a residential environment. Certification is required for Class B. Test data must be submitted to the agency with an equipment sample for testing by the FCC or an FCC authorized laboratory. The specified frequency range is 450 kHz to 30 MHz.

VDE—If the equipment meets the requirements of VDE Level B, the manufacturer is given general approval and no operating license is required. The specified frequency range for Level B is 10 kHz to 30 MHz.

Allowable levels for conducted emissions are shown in Figure 4. Conducted EMI/RFI is often effectively blocked in switching power supplies through the use of on-board line filters. Radiated EMI/RFI is noise directly transmitted into free space. Direct radiation is suppressed by enclosing the final system assembly in a metal cabinet. If a plastic enclosure is used, it can be coated with a conductive spray to form a continuous shield.

The system designer must keep in mind that EMI/RFI interference is not a problem solely for switching power supplies. Any piece of computing equipment contains many subassemblies that produce noise. The problem must be evaluated on a system basis with regard to shielding and filtration.

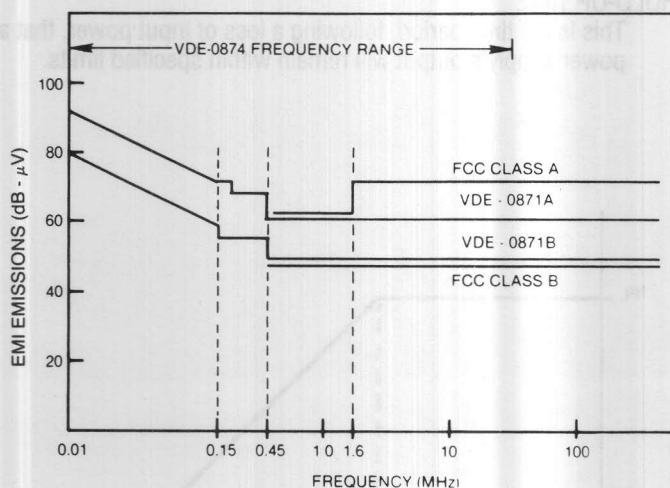


Figure 4: VDE and FCC Regulations Set the Allowable Noise Emission Level for Computing Equipment

POWER SUPPLY SAFETY

Power supplies are generally designed to meet certain national and international standards, the most common being those of UL, CSA, VDE, and IEC. The regulations of these safety agencies fulfill the majority of requirements for other local safety agencies.

UL—Underwriters Laboratories is a US-based agency that sets safety regulations and tests for safety. The most commonly used standard for power supplies is UL1950 for Electronic Data Processing Equipment.

Two levels for testing have been established by UL: UL listing for end-user products, and UL recognition for components and subassemblies.

CSA—The Canadian Standards Association (CSA): It works in much the same way as UL. Essentially CSA sets and verifies conformance to Canadian safety regulations.

The standards of primary interest to power supply manufacturers are those concerning data processing equipment (C22.2 No. 234: Safety of Component Power Supplies).

IEC—The International Electrotechnical Commission: It sets safety standards. While not officially recognized by any government, IEC standards do form the basis for the regulations of other agencies. The standard governing office machines is I.E.C. No. 950.

VDE—Verband Deutscher Electronotechniker (VDE): A German agency, it sets the most stringent electrical safety standards for power supplies. Both VDE and Technische Überwachungs-Verein (TUV) are authorized to test and certify products to these standards. The safety specification normally used for power supplies is VDE0805/EN60950.

AUSTEL—Formally, Telecom Australia, it is an engineering division of Australian Defense Industrial. The division tests for compliance to Australian Safety Standard 3548.

The regulatory agencies are most concerned about component spacing, high-potential isolation, leakage currents, insulation resistance and printed circuit board flammability. Important transformer specifications are insulation, dielectric strength, clearance distances, moisture resistance, and temperature rating.

GLOSSARY — Switching Power Supply Terms

AMBIENT TEMPERATURE

The temperature of the still air immediately surrounding an operating power supply is the ambient temperature.

AUTORANGING INPUT

An input voltage sensing circuit in the power supply automatically switches to the appropriate input voltage range (85-130VAC or 180-265VAC).

BROWN-OUT PROTECTION

Circuitry shuts down a power supply under very low line conditions. This feature can save a power supply from possible failure due to a brown-out.

BREAKDOWN VOLTAGE

The maximum ac or dc voltage that can be applied between input and output terminals of a power supply without causing damage is the breakdown voltage. See Figure 1.

C.S.A.

The Canadian Standards Association is an independent testing and safety standard agency.

CROSS-REGULATION

In a multiple output power supply, cross-regulation is the change allowed in one output caused by a specified change in load on another output. It is normally expressed as a percentage of output voltage.

CROWBAR

See Over-Voltage Protection.

CURRENT LIMITING

See Output Current Limiting.

DERATING

The reduction in rated power output of power supply is a function of elevated ambient temperature. It is normally expressed as a percent per degree centigrade. See Figure 2.

EFFICIENCY

The ratio of output power at the load to input power consumption expressed as a percentage: Efficiency is usually measured at rated output power and nominal line conditions.

EMI

Electromagnetic interference is noise generated by switching action of power supply, classified as conducted or radiated. Conducted EMI is that portion reflected back into the power line. Radiated EMI refers to the portion radiated into free space.

F.C.C.

The Federal Communications Commission is a U.S. government agency that regulates conducted and radiated emission levels.

FLYBACK CONVERTER

A switching power supply design that uses a single transistor switch and requires no output inductor: While the transistor is ON, energy is accumulated in the transformer primary. During the flyback period, when the transistor is OFF, this energy is transferred to the transformer secondary and the load. This technique is cost-effective over an output power range of approximately 25 to 100 watts.

FORWARD CONVERTER

A switching power supply design technique that uses a single transistor switch: Unlike the "flyback" design, energy is transferred to the transformer secondary while the transistor switch is ON and stored in an output inductor. This technique has a cost-effective output power range of approximately 80 to 200 watts.

HALF-BRIDGE CONVERTER

A switching power supply design in which two transistor switches are used to drive the transformer primary: This technique has a cost effective power range of 150 to 500 watts.

HI-POT TEST

A high-potential or high-voltage test is used to ensure that a power supply passes its minimum breakdown voltage rating.

HOLD-UP TIME

This is the time period, following a loss of input power, that a power supply's output will remain within specified limits.

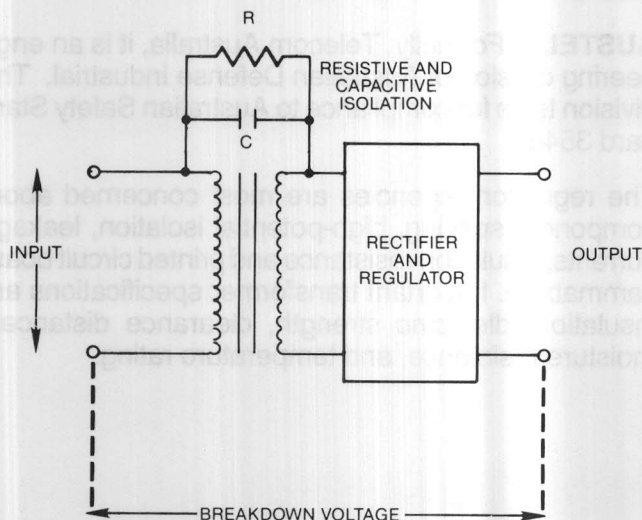


Figure 1: Breakdown Voltage and Isolation

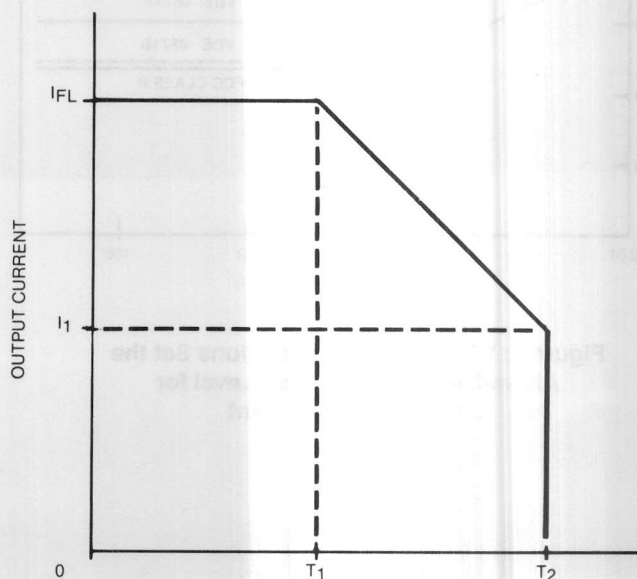


Figure 2: Power Supply Derating Curve

GLOSSARY — Switching Power Supply Terms

INPUT LINE TRANSIENT PROTECTION

A power supply with this safeguard can withstand a line spike of considerable amplitude for a short period of time. All new Power General power supplies can survive line spike testing in accordance with IEEE 587-1980.

INPUT VOLTAGE RANGE

The range is defined by minimum and maximum input voltage limits within which a power supply will operate as specified.

IN-RUSH CURRENT

In-rush is the maximum instantaneous value of current drawn by a power supply at start-up. It is also called input surge.

INVERTER

An inverter is a power conversion circuit that changes dc to ac.

ISOLATION

Electrical isolation between input and output of a power supply, given in values of voltage and/or capacitance, is normally determined by transformer characteristics and circuit spacing.

LINEAR REGULATION

In this regulation technique, a control device (normally a transistor) is placed in series or in parallel with the load. Voltage across the load is regulated by varying the effective resistance of that control device in order to dissipate unused power. See Post-Regulation.

LINE REGULATION

This change in output voltage is due to variations in the input voltage over a specified limit (with all other factors held constant). It is normally expressed as a percentage of output voltage.

LOAD REGULATION

Load regulation is the change in output voltage, due to variations in the output load, over specified limits with all other factors held constant. It is normally expressed as a percentage of output voltage.

LOGIC INHIBIT/ ENABLE

It is a logic signal (normally TTL-compatible) that turns a power supply output OFF or ON.

MINIMUM LOAD SPECIFICATION

Many switching power supplies require a minimum load if the outputs are to stay within specifications.

MTBF

Mean Time Between Failure is a measurement of the relative reliability of a power supply based upon actual operating data or calculations specified in MIL-HDBK 217E.

OFF-LINE POWER SUPPLY

A power supply in which the ac line input is rectified and filtered directly without using an isolation transformer is called an off-line supply.

OPERATING TEMPERATURE RANGE

See Temperature Range, Operating.

OUTPUT CURRENT LIMITING

It is a method of protecting a power supply from damage under overload conditions by automatically limiting the maximum output current to a predetermined value. See Figure 3.

OUTPUT RIPPLE AND NOISE

The amplitude of ac voltage superimposed on the dc output is usually specified at full load in peak-to-peak or RMS volts. See Figure 3 and PARD.

OUTPUT VOLTAGE

This regulated dc voltage is measured at the output terminals of a power supply.

OUTPUT VOLTAGE TOLERANCE (ACCURACY)

It is the maximum specified deviation of the dc output voltage from its rated value.

OVERSHOOT/UNDERSHOOT

This transient output voltage, beyond the specified accuracy limits, is generally caused by power supply start-up or shut-down or by a step change in line or load.

OVER-VOLTAGE PROTECTION (OVP)

This safeguard is implemented by a device or circuit that shuts down or crowbars (shorts) the power supply output if the output voltage exceeds a specified limit.

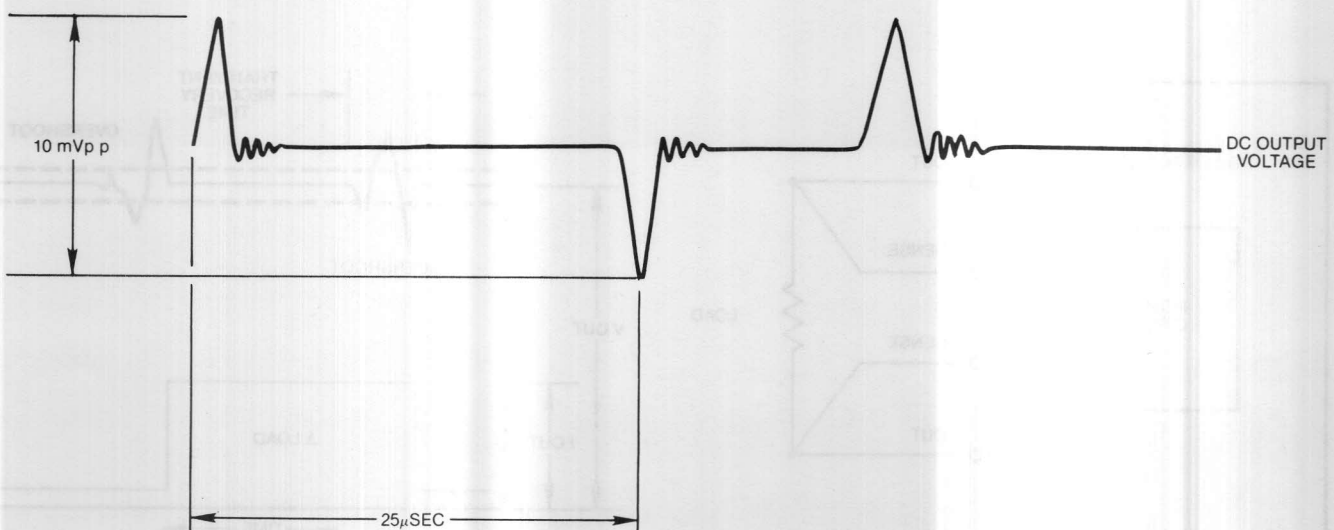


Figure 3: Output Ripple and Noise

GLOSSARY — Switching Power Supply Terms

PARALLEL OPERATION

Supplies can be connected in parallel so that currents from corresponding outputs can be summed for a single load.

PARD

Periodic and random deviations: See Output Ripple and Noise.

PEAK OUTPUT CURRENT

It is the maximum current that can be delivered to a load under transient conditions.

PULSE LOADING

See Peak Output Current.

PI FILTER

This input filter, consisting of two parallel capacitors and a series inductance, is used to reduce reflected ripple current.

POST-REGULATION

A linear regulator is sometimes used on a switching supply output to improve line/load regulation and reduce noise. See Linear Regulation.

POWER-FAIL

This function is implemented by a circuit that monitors the input voltage and provides a logic signal (normally TTL-compatible) at low-line or loss-of-line conditions.

PULSE-WIDTH MODULATION

This voltage regulation circuit is used in switching power supplies in which the power supply output is controlled by varying the conduction time of the switching transistors.

SOFT START

This protective function is provided by a circuit that limits the input surge current (in-rush current) to an off-line power supply at start-up.

RATED OUTPUT CURRENT

It is the maximum current that can be continuously drawn from the output of a power supply

REMOTE SENSING

It is a method of maintaining rated, well-regulated voltage from a power supply across a distant load and compensating for voltage drops on the output lines. See Figure 4.

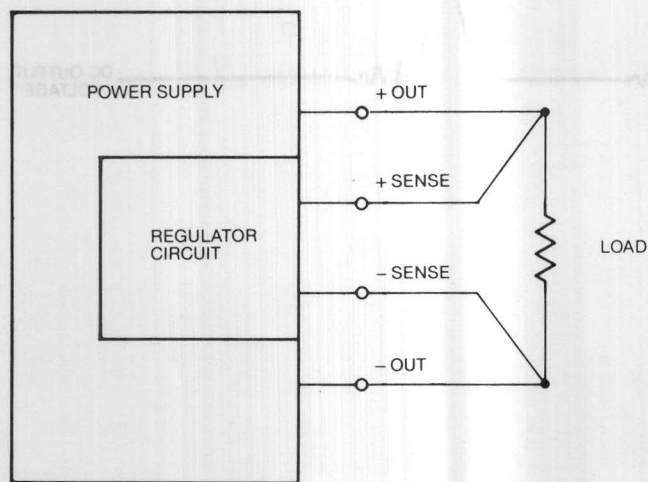


Figure 4: Remote Sensing

REMOTE SHUTDOWN

See Logic Inhibit/Enable.

SWITCHING FREQUENCY

This is the rate at which the dc voltage is switched or chopped in an off-line switching power supply.

TEMPERATURE COEFFICIENT

The average change in output voltage per degree centigrade change in ambient temperature over a specified temperature range: It is usually expressed as a percentage of rated output voltage per degree centigrade.

TEMPERATURE RANGE, OPERATING

This range of ambient temperatures is defined by minimum/maximum limits over which a power supply can be expected to operate as specified.

TEMPERATURE RANGE, STORAGE

This is the range of ambient temperatures over which a power supply can be safely stored.

THERMAL SHUTDOWN

A power supply with this feature shuts down if a maximum operating temperature is exceeded.

TRANSIENT RECOVERY TIME

It is the time required for the power supply output voltage to return to within a specified percentage of rated value following a step change in load current. See Figure 5.

U.L.

Underwriters Laboratories an independent, non-profit organization that certifies that products meet safety standards.

UNIVERSAL INPUT

Universal input is a power supply input voltage range of 85-265VAC; no reconfiguration is needed.

VDE

Verband Deutscher Elektrotechniker is a German organization that sets safety standards and tests products for safety.

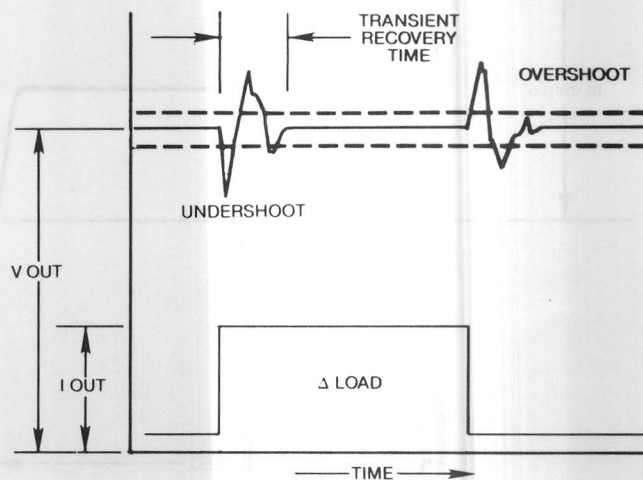


Figure 5: Transient Recovery Time

APPLICATION NOTES — AC/DC Power Supplies

AC INPUT LINE CONNECTIONS

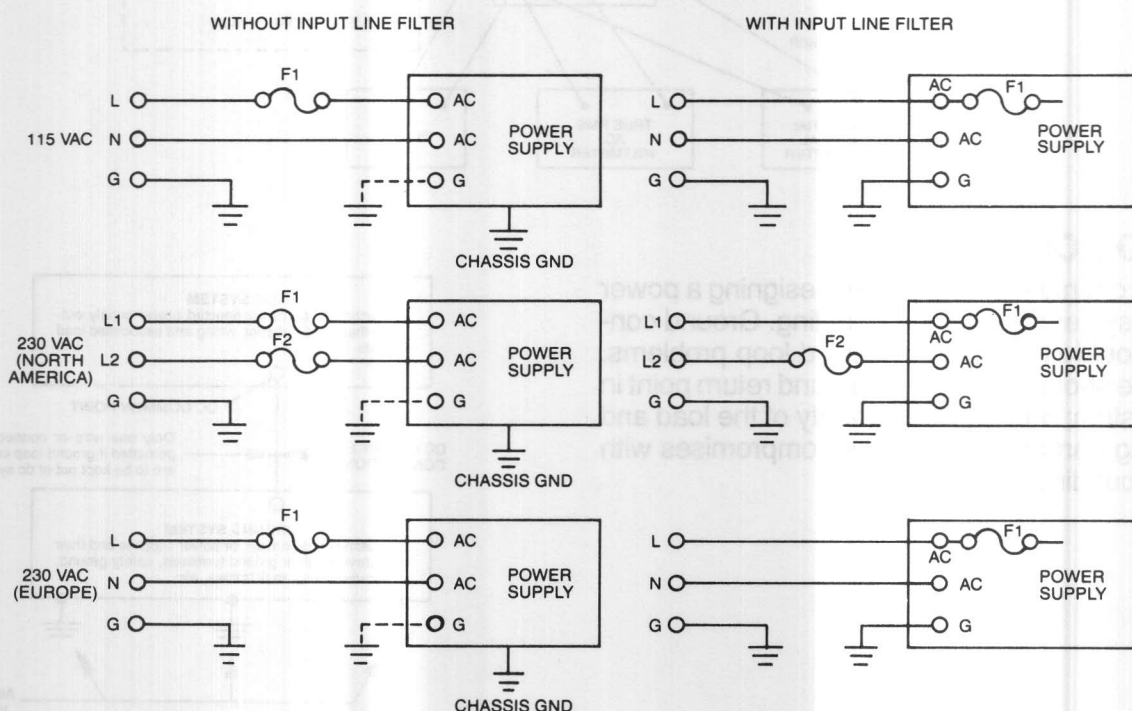
The integrity of the ac line (L), ac neutral (N) and third wire safety ground (G) from the ac power outlet to the power supply input terminals should be retained without accidental interchange.

The accidental interchange of the ac line and ac neutral places power supply switches and fuses in series with the neutral side of the power line instead of the hot side. The components within the power supply are then exposed to the hot side of the input power line, even if the ac line switch is turned off or the fuse blows.

If the ac line and safety ground leads are accidentally interchanged, the power supply chassis is elevated to an ac potential equal to the input line voltage. If the chassis is improperly grounded, this could result in a lethal shock hazard.

Accidental interchange of ac neutral and safety ground leads may result in ground currents flowing through the power supply chassis and other associated ground paths because the chassis is at ac neutral. This causes improper power supply operation.

AC INPUT CONNECTIONS



NOTES:

1. Models with on-board fuses have fuse F1 factory installed. Fuse F2 must be supplied by the user. It is external to the power supply.
2. When connecting ac to a power supply, it is necessary to use a wire size that is rated to carry at least the maximum power supply input current.
3. Refer to appropriate data sheet or contact the manufacturer for proper fuse rating.
4. The safety ground should always be connected to the power supply chassis and the chassis system. When the power supply chassis is not available, the system case or chassis should be used.

APPLICATION NOTES — AC/DC Power Supplies

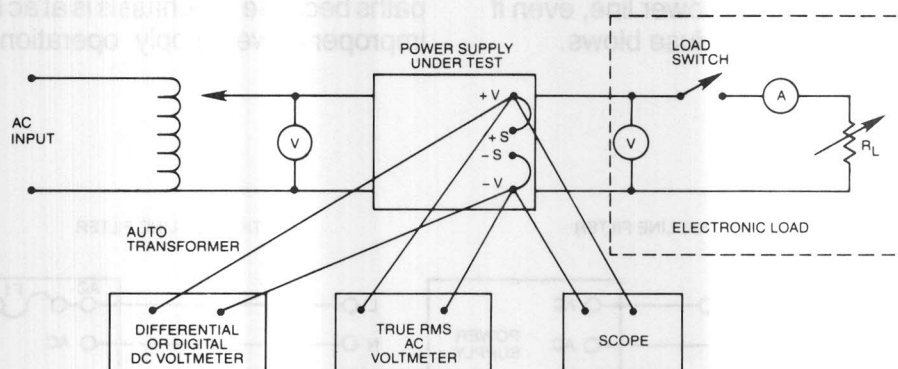
MEASUREMENT TECHNIQUES

All performance measurements for a constant-voltage power supply should be made directly at the power supply terminals.

Pre-Measurement Conditions:

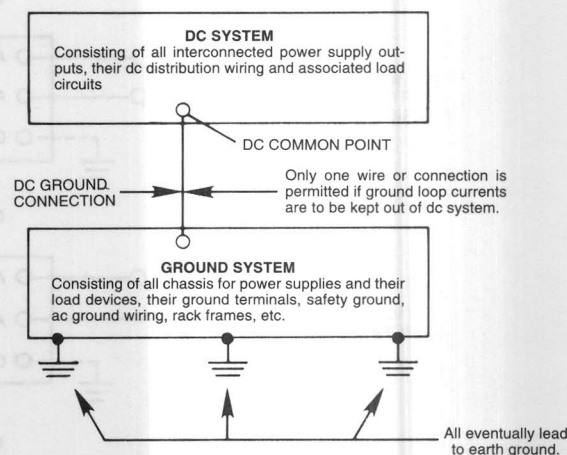
- Measure performance at the front or rear terminals.
- Connect all test instruments to the power supply terminals properly using separate leads to all measuring devices.

- Terminate test leads with solder or spade-type lugs.
- Use an adequate load resistor.
- Check current limit control set point.
- Connect the input ac power source and monitor it properly.
- Use an auto-transformer of adequate current rating.
- After connecting the test system, check for system-generated noise and ripple.



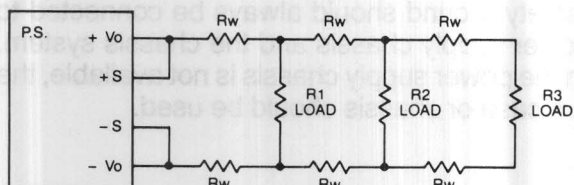
GROUND CONNECTIONS

One aspect often overlooked when designing a power distribution system is system grounding. Ground connections should system avoid ground loop problems. Ideally, there should be only one ground return point in a supply system; however, complexity of the load and the dc wiring harness often forces compromises with the ideal grounding concept.



LOAD CONNECTIONS WITH A SINGLE SUPPLY

The simplest and most common example of improper load wiring is shown below.

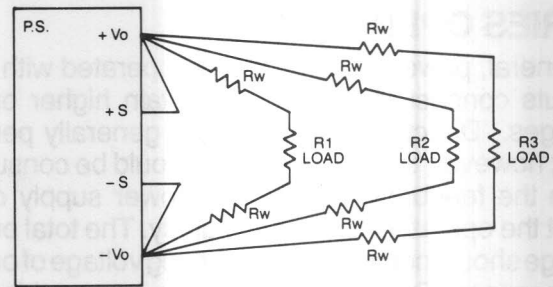


In this case, the voltage at each load is dependent on the current drawn by the other loads. Poor regulation occurs due to voltage drops across wires. In some cases, interaction of the loads can be ignored, but in most applications the resulting noise, pulse coupling, or tendency toward inter-load oscillation is undesirable and unacceptable. Problems may be caused by ground loops if analog and digital circuits are connected together. A low-level analog signal should not share conduction path with digital signals or power returns.

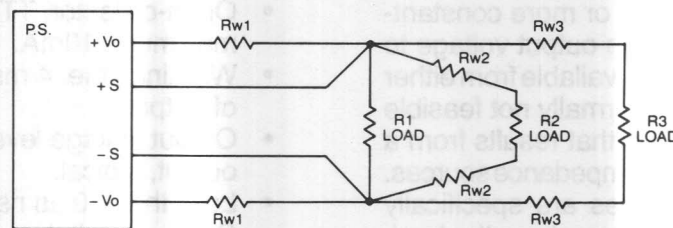
APPLICATION NOTES — AC/DC Power Supplies

A better method of connecting multiple load systems and improving circuit operation is at right:

There are no interactions because all load circuits are effectively terminated at the power supply. Remote sensing at the R_1 load improves regulation at R_3 . If the loads are equal and R_w is balanced, all load voltages will be virtually identical to that at R_1 . The distribution wiring should be chosen with care.



As an alternate approach the circuit below can be used.



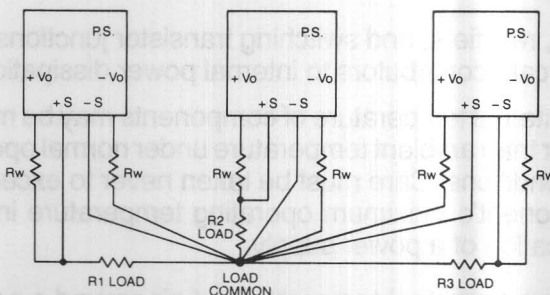
Here R_{w1} disperses distribution losses to the heavy load R_1 . This load is remotely sensed. Loads R_2 and R_3 are tied to the same point, but are small with respect to R_1 .

Satisfactory regulation can be achieved by this method. (R_{w1} is heavy-gauge wire.)

LOAD CONNECTIONS WITH MULTIPLE SUPPLIES

The following is the recommended method of connection.

Both remote and local sensing can be used, depending on the regulation required and the loads. The chassis ground connections should be made at one point.



A local decoupling capacitor, if required, can be connected across each pair of load and distribution terminals. This reduces the high-frequency impedance seen by any individual load looking back toward the power supply and reduces high-frequency mutual coupling effects between loads fed from the same power supply.

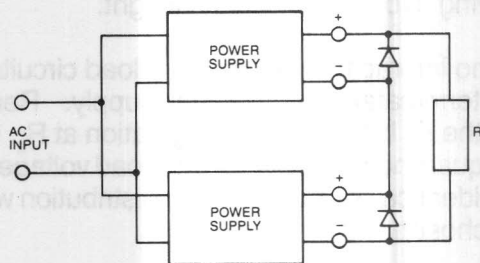
As a minimum, each load wire must be of sufficient size to carry the power supply output current that would flow if associated load terminals are short-circuited.

During normal operating conditions, some component temperatures may exceed the rating of wiring types commonly used in applications. It is recommended that all wiring in end-product applications be routed and tied away from contact with the power supply.

APPLICATION NOTES — AC/DC Power Supplies

SERIES OPERATION

In general, power supplies can be operated with their outputs connected in series to obtain higher output voltages. Direct series coupling is generally permissible; however, the manufacturer should be consulted, since the feedback loop of one power supply could affect the operation of another supply. The total output voltage should not exceed the working voltage of output components. External diodes have been added for reverse voltage protection.



PARALLEL OPERATION

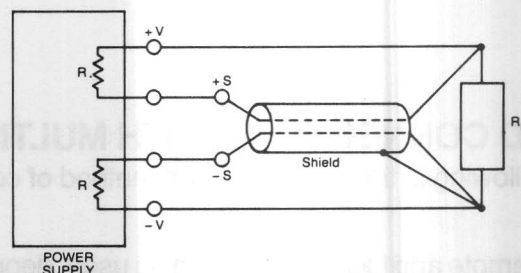
Parallel operation is the use of two or more constant-voltage power supplies of the same output voltage to obtain higher output current than is available from either supply alone. Such operation is normally not feasible due to the large circulating current that results from a voltage difference between two low-impedance sources. However, if the two power supplies are specifically designed for such operation, they may share the load.

POWER FAIL CHARACTERISTICS

- Open-collector, TTL-compatible, 35V maximum, 10mA.
- Warning time: 4 ms, minimum, before loss of output.
- Output voltage level detect: 95% of rated output, typical.
- Less than 10 μ s rise or fall time.
- Open = Fault; Low = Operational.

REMOTE SENSING

A constant-voltage power supply with remote sensing monitors and regulates its output voltage directly at the load terminals. Two low-current sensing leads between the load terminals, and special sensing terminals located on the power supply, permit the power supply output to compensate for IR drops in the load leads. Shielding may be provided to prevent noise pickup by the regulation circuit of the power supply.



THERMAL MANAGEMENT

Good engineering design practice must be followed to ensure optimum power supply performance. Heat generated by internal power dissipation must be effectively removed to prevent excessive component temperature rise. The amount of input power dissipated as heat depends on the efficiency of the power supply. Efficiency is the ratio of output power to input power, expressed as a percentage:

$$\eta = P_O / P_{IN} \times 100\%$$

Internal power losses are given by $P_D = P_{IN} - P_O$ or $P_D = P_O (100 - \eta) / \eta$. Power transformers, series-pass regu-

lators, rectifiers, and switching transistor junctions are significant contributors to internal power dissipation.

The internal temperature of components may be much higher than ambient temperature under normal operating conditions. Care must be taken never to exceed a component's maximum operating temperature in the application of a power supply.

When the ambient temperature of air around a power supply is known, other design factors affecting operating temperature can be determined. These include component spacing, heat sink requirements, and the need for forced air cooling or derated operation.

20W DUAL OUTPUT SWITCHING POWER SUPPLIES

—UNIVERSAL INPUT, ULTRA-HIGH RELIABILITY—

FEATURES

- 85-265 VAC Input Voltage Range
- 20 Watts Continuous Output Power
- UL1950 Approved
- CSA C22.2-950 Approved
- Meets VDE0805
- TUV/EN60950/IEC950 Approved
- VDE/FCC Class B Input Line Filter
- 0% Minimum Load on Both Outputs
- Indefinite Short-Circuit Protection
- 2-Year Warranty
- **Minimum 210,000 Hours MTBF**

APPLICATIONS

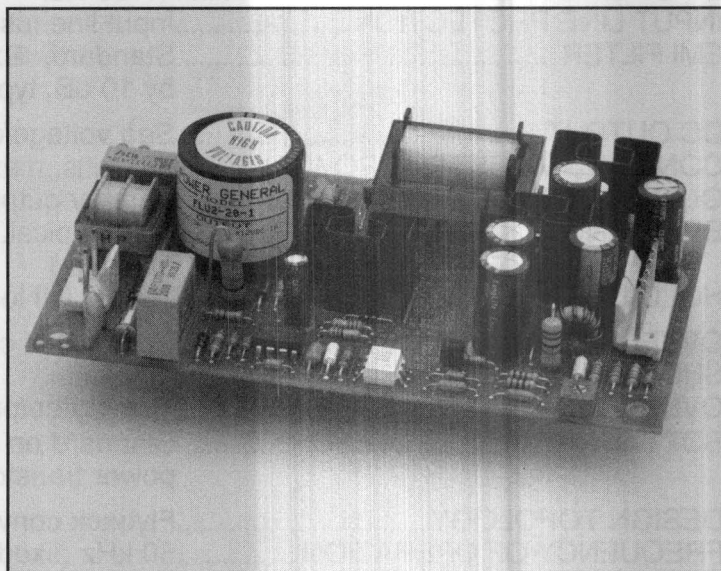
- Data Communications Equipment
- Industrial Control Equipment
- Instrumentation/Terminals
- Disk/Tape Drive Subsystems

FLU2-20 is a series of dual output, 20-watt, open-frame switching power supplies with international safety agency approvals. The supplies offer high-performance features such as a universal input range of 85 VAC to 265 VAC (or 100-370 VDC) and an on-board EMI suppression filter that complies to VDE/FCC Class B specifications.

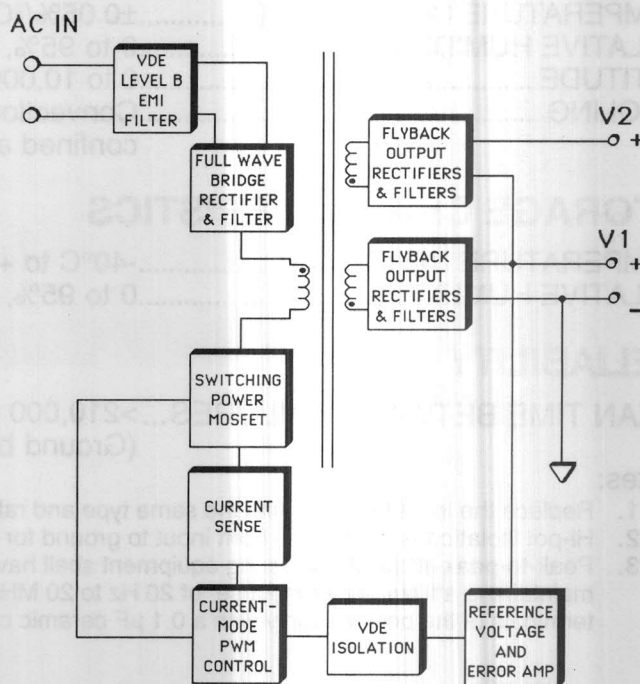
Three models provide a tightly regulated primary output of 5.0 VDC with a regulated secondary output of 12, 15, or 24 VDC. Standard features include 16-millisecond hold-up time, 5300 VDC input/output isolation and an on-board input line fuse. The series provides soft start, indefinite short-circuit protection, over-voltage protection and current limiting. Efficiency is typically 65 percent. The primary output is adjustable ± 5 percent.

The Power General FLU2-20 series is designed for ultra-high reliability. The minimum MTBF (calculated using the "parts stress" method of MIL-HDBK 217E) is 210,000 hours. Operation is specified over the temperature range of 0°C to +70°C with cooling by natural convection.

All models are fabricated on a compact 3.0 x 5.0-inch printed circuit board with a maximum component height of 1.2 inches.



FUNCTIONAL BLOCK DIAGRAM



FLU2-20 SERIES

GENERAL SPECIFICATIONS

AC INPUT	Universal input voltage range 85-265 VAC single phase or 100-370 VDC.
INPUT LINE FREQUENCY	47-63 Hz.
INPUT LINE PROTECTION	Input line fuse on-board. (See Note 1.)
EMI FILTER	Standard. Exceeds minimum requirements of VDE/FCC Class B by 10 dB, typical.
DC OUTPUT	See voltage/current rating chart.
CONTINUOUS OUTPUT POWER	20 watts, maximum.
OUTPUT VOLTAGE ADJUST	Primary output adjustable $\pm 5\%$. Auxiliary outputs fixed.
EFFICIENCY	65%, typical. (Nominal input voltage line conditions and full load.)
HOLD-UP TIME	16 ms, full load conditions.
OVERLOAD PROTECTION	Power-limit circuit.
SHORT-CIRCUIT PROTECTION	Indefinite.
OVER-VOLTAGE PROTECTION	Primary output (V ₁) only.
SOFT START	Standard on all models. Prevents output overshoot and power transformer saturation at turn-on.
DESIGN TOPOLOGY	Flyback converter, current-mode control.
FREQUENCY OF OPERATION	50 kHz (fixed).
HI-POT ISOLATION	5300 VDC, input-to-output for one minute. (See Note 2.)
NOISE, RIPPLE & SPIKES	1% peak-to-peak, maximum. (See Note 3.)

ENVIRONMENTAL OPERATING CHARACTERISTICS

TEMPERATURE RANGE	0°C to +70°C.
OUTPUT POWER DERATING	Derate output power and current linearly 2%/°C from +50°C to +70°C.
TEMPERATURE COEFFICIENT	$\pm 0.05\%/^{\circ}\text{C}$ over the entire operating temperature range.
RELATIVE HUMIDITY	0 to 95%, non-condensing.
ALTITUDE	0 to 10,000 feet.
COOLING	Convection cooling is adequate. When operating in a confined area, moving air is recommended.

STORAGE CHARACTERISTICS

TEMPERATURE RANGE	-40°C to +85°C.
RELATIVE HUMIDITY	0 to 95%, non-condensing.

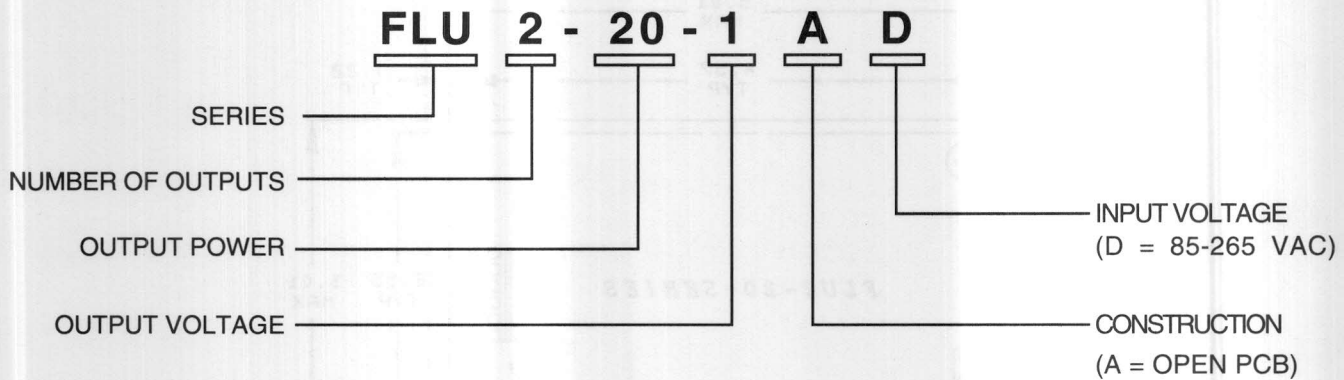
RELIABILITY

MEAN TIME BETWEEN FAILURES... >210,000 hours, per MIL-HDBK 217E Parts Stress Method. (Ground benign, +25°C.)

Notes:

1. Replace the input line fuse with the same type and rating. Recommended: **2.0A/250 VAC slow-blow fuse**.
2. Hi-pot isolation is 2200 VDC from input to ground for 60 seconds.
3. Peak-to-peak and RMS metering equipment shall have a 20 MHz frequency response with probes and cables maintaining a frequency response of 20 Hz to 20 MHz. Output ripple and spikes are measured directly at the output terminals of the power supply with a 0.1 μF ceramic capacitor without the use of the probe ground clip.

MODEL SELECTION GUIDE



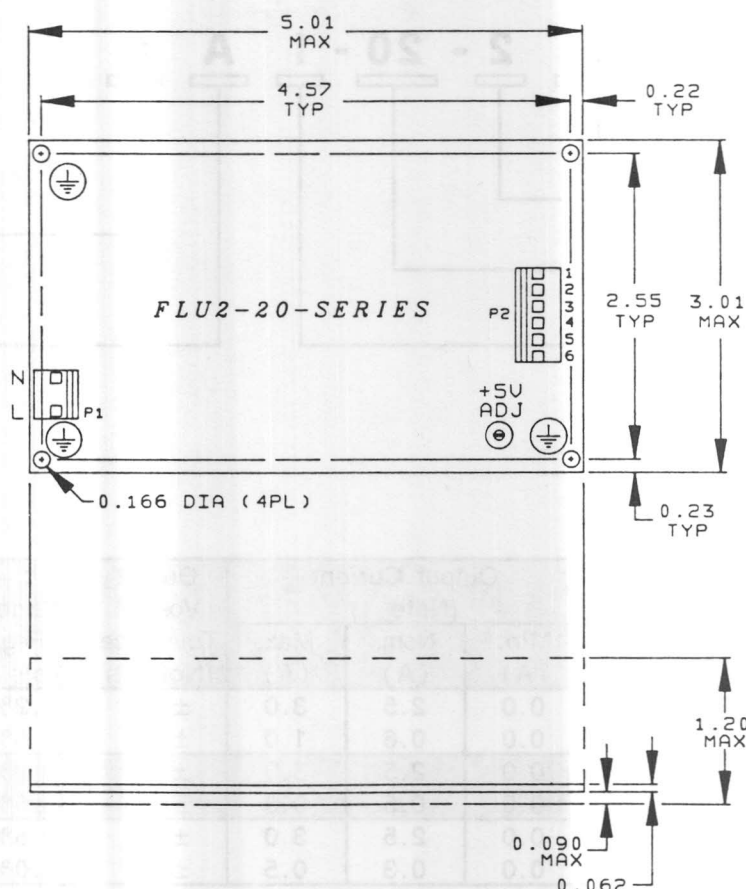
Model Number	Output Voltage		Output Current (Note 1)			Output Voltage Tolerance (Note 2)	Line Reg. (Note 3)	Load Reg. (Note 4)	Cross Reg. (Note 5)
			Min.	Nom.	Max.				
	Output	(V)	(A)	(A)	(A)				
FLU2-20-1	V1	+5.0	0.0	2.5	3.0	±1%	0.2%	1.0%	—
	V2	+12	0.0	0.6	1.0	±5%	0.5%	3.0%	4.0%
FLU2-20-2	V1	+5.0	0.0	2.5	3.0	±1%	0.2%	1.0%	—
	V2	+15	0.0	0.5	0.8	±5%	0.5%	3.0%	4.0%
FLU2-20-3	V1	+5.0	0.0	2.5	3.0	±1%	0.5%	1.0%	—
	V2	+24	0.0	0.3	0.5	±5%	1.0%	3.0%	4.0%

Notes:

1. The sum of the primary and auxiliary load currents must not exceed 3.1A.
2. Output voltage tolerance is measured at nominal load conditions.
3. Line regulation is measured under nominal load conditions with the input voltage varied from 85 to 265 VAC.
4. Load regulation on each output is measured from 60 percent of nominal load. The load current is varied +40/-30 percent of nominal while the other output is held at nominal load.
5. Cross regulation is tested by changing the load on the primary output from 50 percent to 100 percent of nominal while measuring the voltage change on the auxiliary output.
6. All measurements should be made directly at the terminals of the power supply.
7. The FLU2-20 Series is approved to UL1950 (File E76127/140439), CSA C22.2-950 (File LR52335) and EN60950/IEC950 (TUV License R9171555).

FLU2-20 SERIES

MECHANICAL OUTLINE AND PIN CONFIGURATION



Notes:

1. Dimensions shown are in inches.
2. Tolerances = 0.00 \pm 0.01 inch.
0.000 \pm 0.005 inch

PIN-OUT

Pin	FLU2-20-1	FLU2-20-2	FLU2-20-3
1	+12V/1.0A	+15V/0.8A	+24V/0.5A
2	COMMON	COMMON	COMMON
3			
4			
5			
6			

CONNECTORS

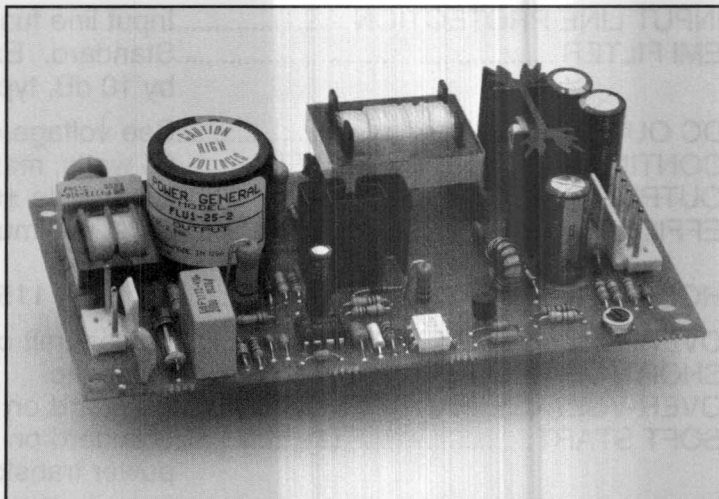
P1 Input Connector MOLEX 09-74-1031		P2 Output Connector MOLEX 09-74-1061	
Pin 1 AC Neutral	Pin 2 AC Line		
MOLEX Mating Connector		MOLEX Mating Connector	
Housing	09-50-1031	Housing	09-50-1061
Crimp Terminal	08-70-1030	Crimp Terminal	08-70-1030

25W SINGLE OUTPUT SWITCHING POWER SUPPLIES

—UNIVERSAL INPUT, ULTRA-HIGH RELIABILITY—

FEATURES

- 85-265 VAC Input Voltage Range
- 25 Watts Continuous Output Power
- Meets UL1950
- Meets CSA C22.2-220/CSA22.2-950
- Meets VDE0805
- Meets EN60950/IEC950
- VDE/FCC Class B Input Line Filter
- 0% Minimum Load Requirement
- Indefinite Short-Circuit Protection
- Compact 5.0 x 2.75 x 1.2-Inch Size
- 2-Year Warranty
- **Minimum 205,000 hours MTBF**



APPLICATIONS

- Data Communications Equipment
- Tape Drive Subsystems
- Microcomputer Systems
- Industrial Equipment

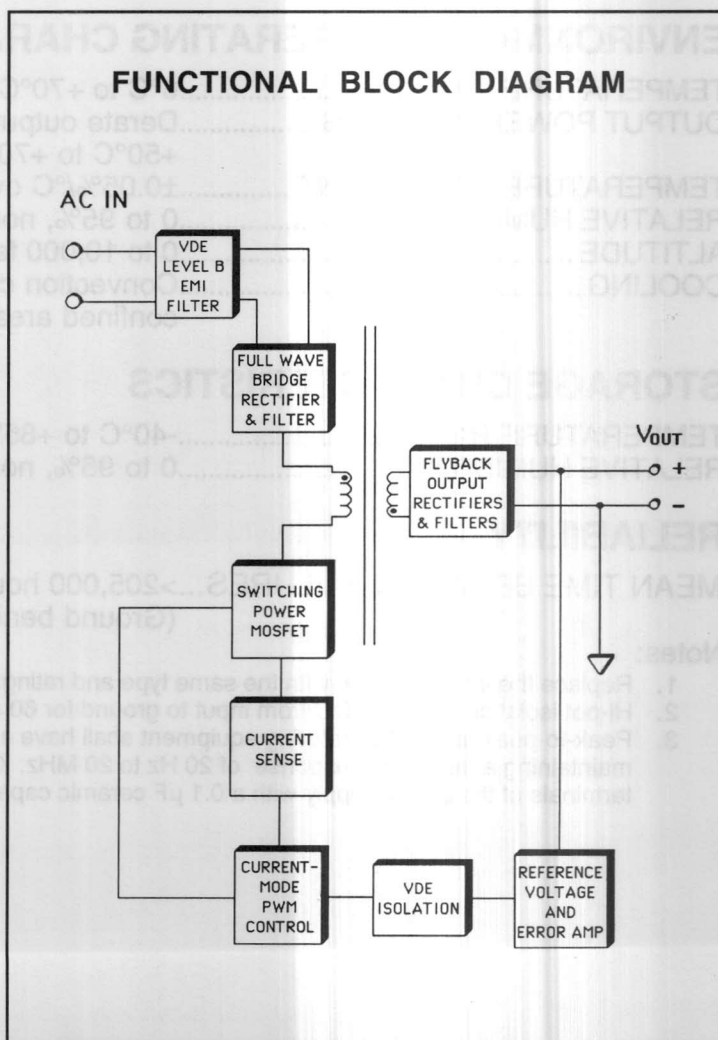
FLU1-25 is a series of single output, 25-watt, open-frame switching power supplies. Designed to meet international safety agency standards, including those of VDE, IEC, UL and CSA, these supplies offer high-performance features such as a universal input range of 85 VAC to 265 VAC (or 100-370 VDC) and an on-board EMI suppression filter that complies to VDE/FCC Class B specifications.

Six models provide regulated outputs of 5.0, 9.0, 12, 15, 24 and 28 VDC. Standard features include 16-millisecond hold-up time, 5300 VDC input/output isolation and an on-board input line fuse. The series provides soft start, indefinite short-circuit protection, over-voltage protection and current limiting. Efficiency is 65 percent, minimum; load regulation is ± 0.3 percent; the output is adjustable ± 5 percent.

The Power General FLU1-25 series is designed for ultra-high reliability. The minimum MTBF (calculated using the "parts stress" method of MIL-HDBK 217E) is 205,000 hours. Operation is specified over the temperature range of 0°C to +70°C with cooling by natural convection.

All models are fabricated on a compact 2.75 x 5.0-inch printed circuit board with a maximum component height of 1.2 inches.

FUNCTIONAL BLOCK DIAGRAM



FLU1-25 SERIES

GENERAL SPECIFICATIONS

AC INPUT	Universal input voltage range 85-265 VAC single phase or 100-370 VDC.
INPUT LINE FREQUENCY.....	47-63 Hz.
INPUT LINE PROTECTION.....	Input line fuse on-board. (See Note 1.)
EMI FILTER	Standard. Exceeds minimum requirements of VDE/FCC Class B by 10 dB, typical.
DC OUTPUT	See voltage/current rating chart.
CONTINUOUS OUTPUT POWER	25 watts, maximum.
OUTPUT VOLTAGE ADJUST.....	Adjustable $\pm 5\%$.
EFFICIENCY	65%, minimum. (Nominal input voltage line conditions and full load.)
HOLD-UP TIME.....	16 ms at 115 VAC, full load conditions.
OVERLOAD PROTECTION.....	Power-limit circuit.
SHORT-CIRCUIT PROTECTION.....	Indefinite.
OVER-VOLTAGE PROTECTION.....	Standard on all models.
SOFT START	Standard on all models. Prevents output overshoot and power transformer saturation at turn-on.
DESIGN TOPOLOGY	Flyback converter, current-mode control.
FREQUENCY OF OPERATION	50 kHz (fixed).
HI-POT ISOLATION.....	5300 VDC, input-to-output for one minute. (See Note 2.)
NOISE, RIPPLE & SPIKES	1% peak-to-peak, maximum. (See Note 3.)

ENVIRONMENTAL OPERATING CHARACTERISTICS

TEMPERATURE RANGE.....	0°C to +70°C.
OUTPUT POWER DERATING	Derate output power and current linearly 2%/°C from +50°C to +70°C.
TEMPERATURE COEFFICIENT.....	$\pm 0.05\%/^{\circ}\text{C}$ over the entire operating temperature range.
RELATIVE HUMIDITY	0 to 95%, non-condensing.
ALTITUDE	0 to 10,000 feet.
COOLING	Convection cooling is adequate. When operating in a confined area, moving air is recommended.

STORAGE CHARACTERISTICS

TEMPERATURE RANGE.....	-40°C to +85°C.
RELATIVE HUMIDITY	0 to 95%, non-condensing.

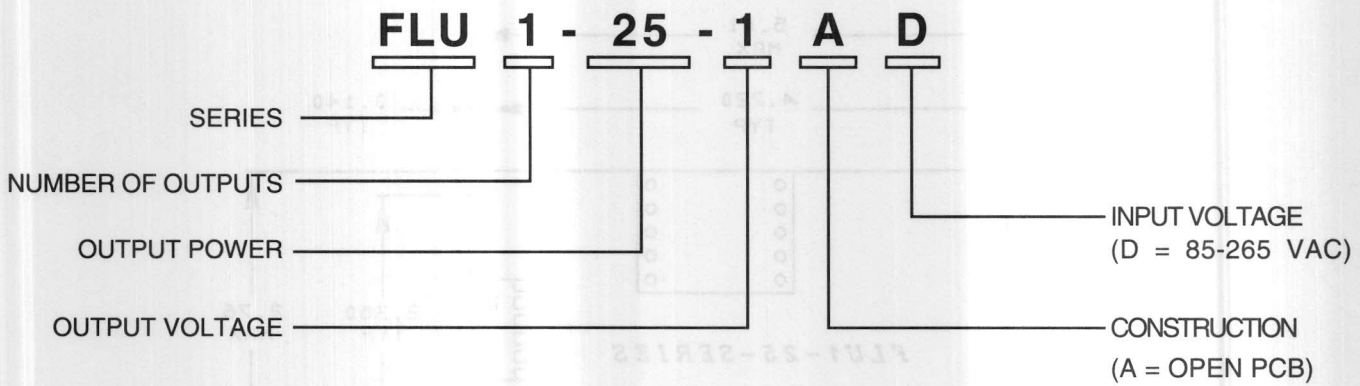
RELIABILITY

MEAN TIME BETWEEN FAILURES...>205,000 hours, per MIL-HDBK 217E Parts Stress Method. (Ground benign, +25°C.)

Notes:

1. Replace the input line fuse with the same type and rating. Recommended: **2.0A/250 VAC slow-blow fuse.**
2. Hi-pot isolation is 2200 VDC from input to ground for 60 seconds.
3. Peak-to-peak and RMS metering equipment shall have a 20 MHz frequency response with probes and cables maintaining a frequency response of 20 Hz to 20 MHz. Output ripple and spikes are measured directly at the output terminals of the power supply with a 0.1 μF ceramic capacitor without the use of the probe ground clip.

MODEL SELECTION GUIDE



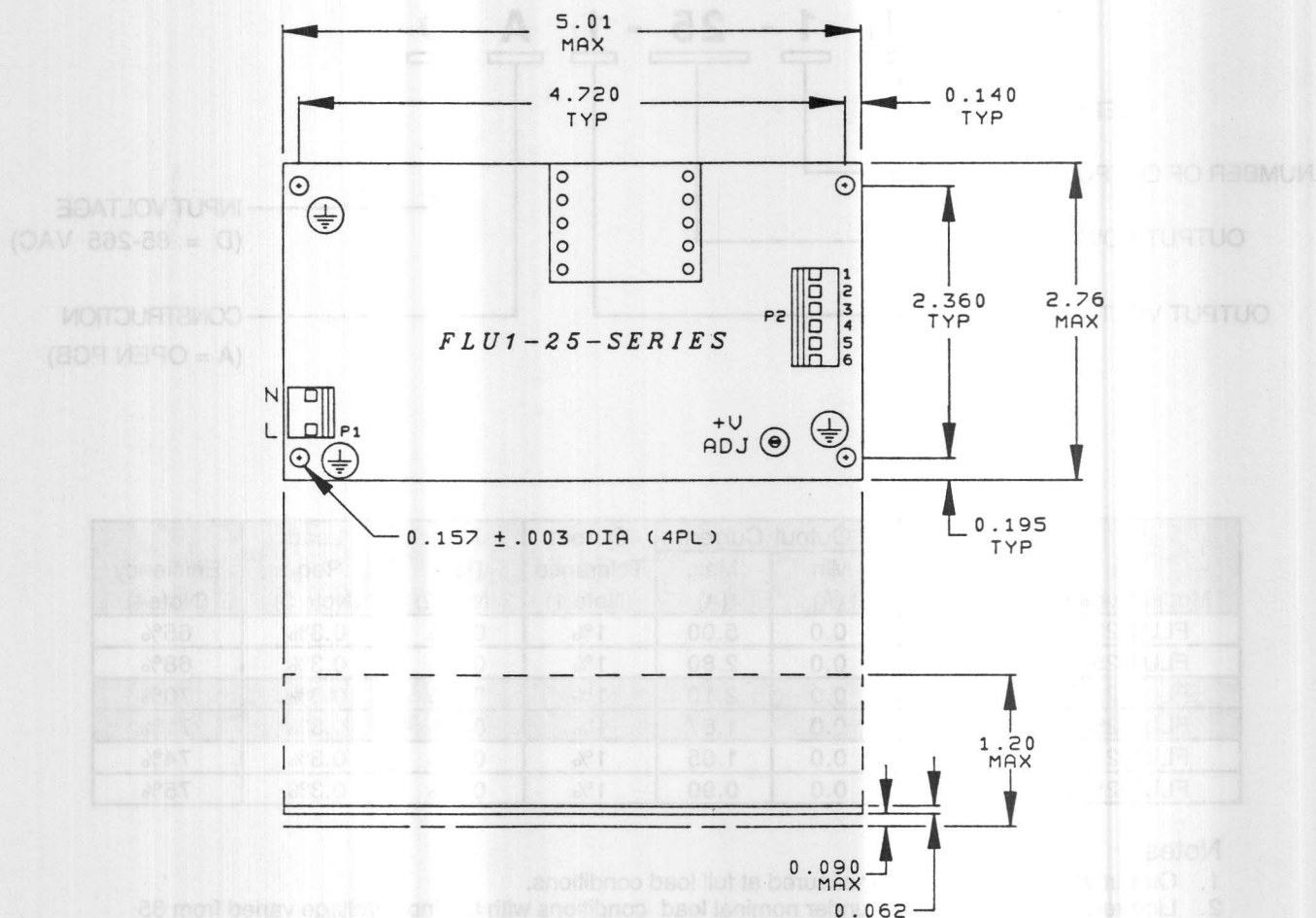
Model Number	Output Voltage (V)	Output Current		Output Tolerance (Note 1)	Line Reg. (Note2)	Load Reg. (Note 3)	Efficiency (Note4)
		Min. (A)	Max. (A)				
FLU1-25-1	5.0	0.0	5.00	1%	0.1%	0.3%	65%
FLU1-25-2	9.0	0.0	2.80	1%	0.1%	0.3%	68%
FLU1-25-3	12	0.0	2.10	1%	0.1%	0.3%	70%
FLU1-25-4	15	0.0	1.67	1%	0.1%	0.3%	71%
FLU1-25-5	24	0.0	1.05	1%	0.1%	0.3%	74%
FLU1-25-6	28	0.0	0.90	1%	0.1%	0.3%	75%

Notes:

1. Output voltage tolerance is measured at full load conditions.
2. Line regulation is measured under nominal load conditions with the input voltage varied from 85 to 265 VAC.
3. Load regulation is measured by varying the load from 0 to 100 percent of rated load.
4. All measurements should be made directly at the terminals of the power supply.

FLU1-25 SERIES

MECHANICAL OUTLINE AND PIN CONFIGURATION



Notes:

1. Dimensions shown are in inches.
2. Tolerances = 0.00 ±0.01 inch.
0.000 ±0.005 inch

PIN-OUT

Pin	FLU1-25-1	FLU1-25-2	FLU1-25-3	FLU1-25-4	FLU1-25-5	FLU1-25-6
1	+5.0V/5.0A	+9.0V/2.8A	+12V/2.1A	+15V/1.67A	+24V/1.05A	+28V/0.9A
2						
3						
4	RETURN	RETURN	RETURN	RETURN	RETURN	RETURN
5						
6						

CONNECTORS

<u>P1 Input Connector</u> MOLEX 09-74-1031		<u>P2 Output Connector</u> MOLEX 09-74-1061	
<u>Pin 1</u> AC Neutral	<u>Pin 2</u> AC Line	MOLEX Mating Connector Housing 09-50-1061 Crimp Terminal 08-70-1030	
MOLEX Mating Connector Housing 09-50-1031 Crimp Terminal 08-70-1030			

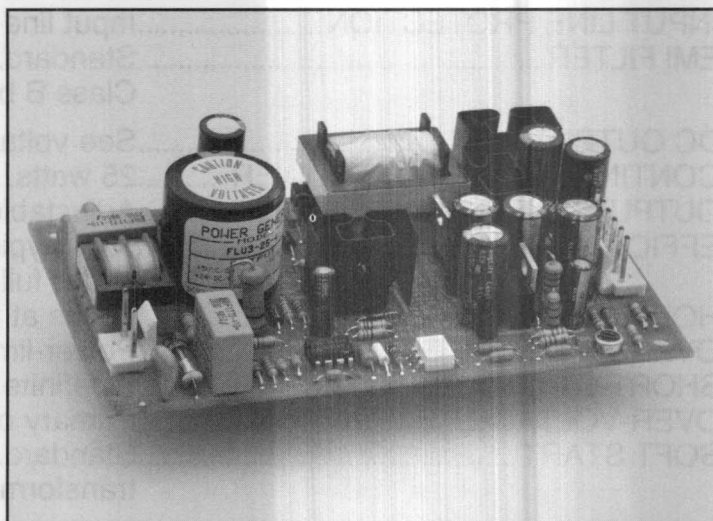
25W TRIPLE OUTPUT SWITCHING POWER SUPPLIES —UNIVERSAL INPUT RANGE, ULTRA-HIGH RELIABILITY—

FEATURES

- Universal Input Voltage Range
- 25 Watts Continuous Output Power
- Meets UL1950
- Meets CSA C22.2-220/CSA22.2-950
- Meets VDE0805
- Meets EN60950/IEC950
- VDE/FCC Class B Input Line Filter
- 0% Minimum Load Requirement
- Over-Current/Short-Circuit Protection
- 2-Year Warranty
- **Minimum 200,000 hours MTBF**

APPLICATIONS

- Disk and Tape Drive Subsystems
- Industrial Controls
- Portable/Battery-Backed Equipment
- Instrumentation Systems



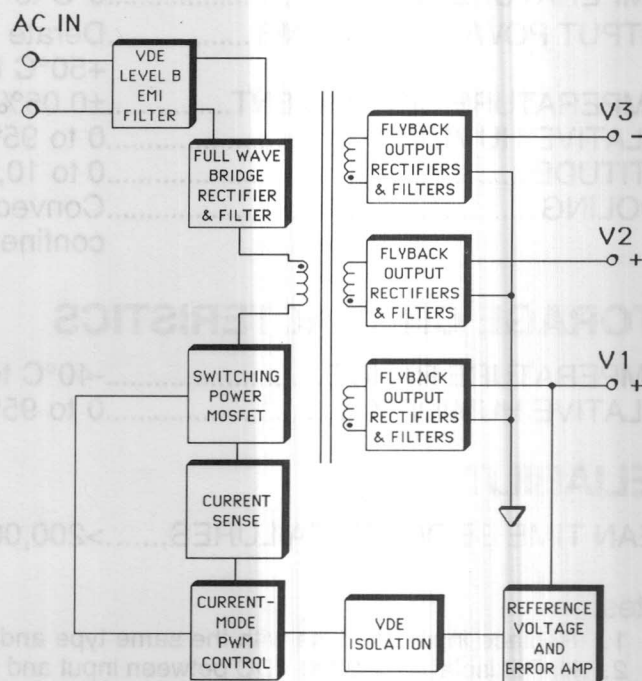
FLU3-25 is a series of three-output, 25-watt, open-frame switching power supplies designed to meet international safety standards, including those of VDE, IEC, UL and CSA. The series offers high-performance features such as a universal input voltage range of 85 VAC to 265 VAC (or 100-370 VDC) and an on-board EMI suppression filter that complies to VDE/FCC Class B specifications.

Four models provide output combinations of +5.0V and $\pm 12V$, +5.0V, +12V and -5.0V, +5.0V and $\pm 15V$, or +5.0V, +24V and -12V. Standard features include 16-millisecond hold-up time, 5300 VDC input/output isolation and an on-board input line fuse. The series provides current limiting, soft start, indefinite short-circuit protection and over-voltage protection. Efficiency is typically 65 percent. The primary output is adjustable ± 5 percent.

The FLU3-25 series exhibits a minimum MTBF (calculated per the "parts stress" method outlined in MIL-HDBK 217E) of 200,000 hours. Operation is specified over the 0°C to +70°C temperature range with cooling by natural convection.

All models are fabricated on a compact 3.0 x 5.0-inch printed circuit board with a maximum component height of 1.2 inches.

FUNCTIONAL BLOCK DIAGRAM



FLU3-25 SERIES

GENERAL SPECIFICATIONS

AC INPUT	Universal input voltage range, 85-265 VAC single phase, or 100-370 VDC.
INPUT LINE FREQUENCY	47-63 Hz.
INPUT LINE PROTECTION	Input line fuse provided on-board. (See Note 1.)
EMI FILTER	Standard. Exceeds minimum requirements of VDE/FCC Class B by 10 dB, typical.
DC OUTPUT	See voltage/current rating chart.
CONTINUOUS OUTPUT POWER	25 watts, maximum.
OUTPUT VOLTAGE ADJUST	Adjustable $\pm 5\%$, primary output only.
EFFICIENCY	65%, typical, measured at nominal input line conditions under full load.
HOLD-UP TIME	16 ms at 115 VAC input.
OVERLOAD PROTECTION	Power-limit circuit.
SHORT-CIRCUIT PROTECTION	Indefinite.
OVER-VOLTAGE PROTECTION	Primary output only.
SOFT START	Standard. Prevents output overshoot and power transformer saturation at turn-on.
DESIGN TOPOLOGY	Flyback converter, current-mode control.
FREQUENCY OF OPERATION	50 kHz (fixed).
HI-POT ISOLATION	5300 VDC, input-to-output for one minute. (See Note 2.)
NOISE, RIPPLE and SPIKES	1% peak-to-peak, maximum. (See Note 3.)

ENVIRONMENTAL OPERATING CHARACTERISTICS

TEMPERATURE RANGE	0°C to +70°C
OUTPUT POWER DERATING	Derate output power and current linearly 2%/°C from +50°C to +70°C.
TEMPERATURE COEFFICIENT	$\pm 0.05\%$ /°C over the entire operating temperature range.
RELATIVE HUMIDITY	0 to 95%, non-condensing.
ALTITUDE	0 to 10,000 feet.
COOLING	Convection cooling is adequate. When operating in a confined area, moving air is recommended.

STORAGE CHARACTERISTICS

TEMPERATURE RANGE	-40°C to +85°C.
RELATIVE HUMIDITY	0 to 95%, non-condensing.

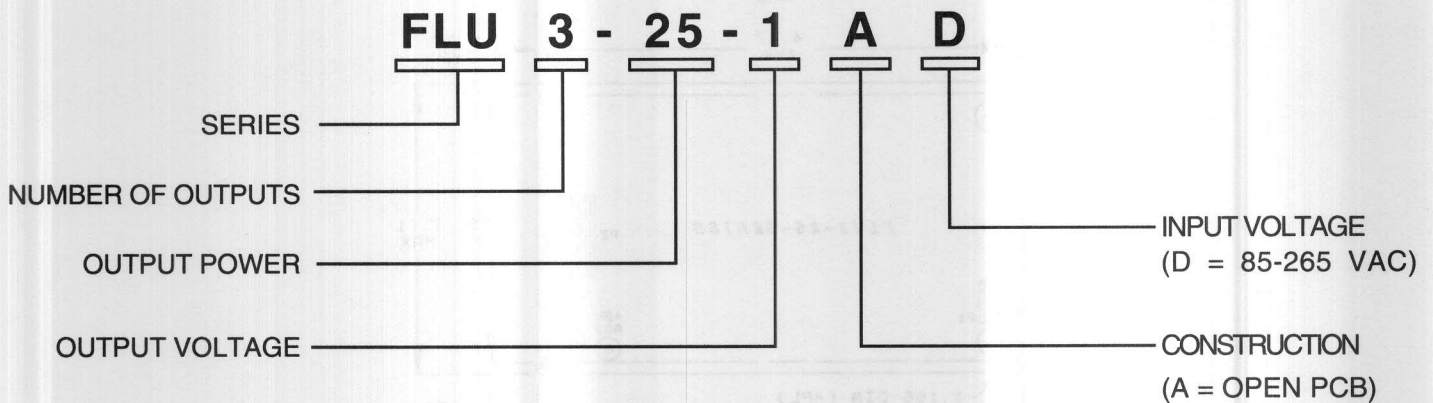
RELIABILITY

MEAN TIME BETWEEN FAILURES.....>200,000 Hours. (See Note 4.)

Notes:

1. Replace input line fuse with the same type and rating. Recommended: **2.0A/250 VAC slow-blow** fuse.
2. Hi-Pot isolation is 2200 VDC between input and ground for one minute.
3. Peak-to-peak and RMS metering equipment shall have a 20 MHz response with probes and cables maintaining a frequency response of 20 Hz to 20 MHz. Output ripple and spikes are measured directly at the output terminals of the power supply across a 0.1 μ F ceramic capacitor without use of the probe ground.
4. Calculated per the "parts stress" method as outlined in MIL-HDBK 217E. Assumes ground benign and +25°C.

MODEL SELECTION GUIDE



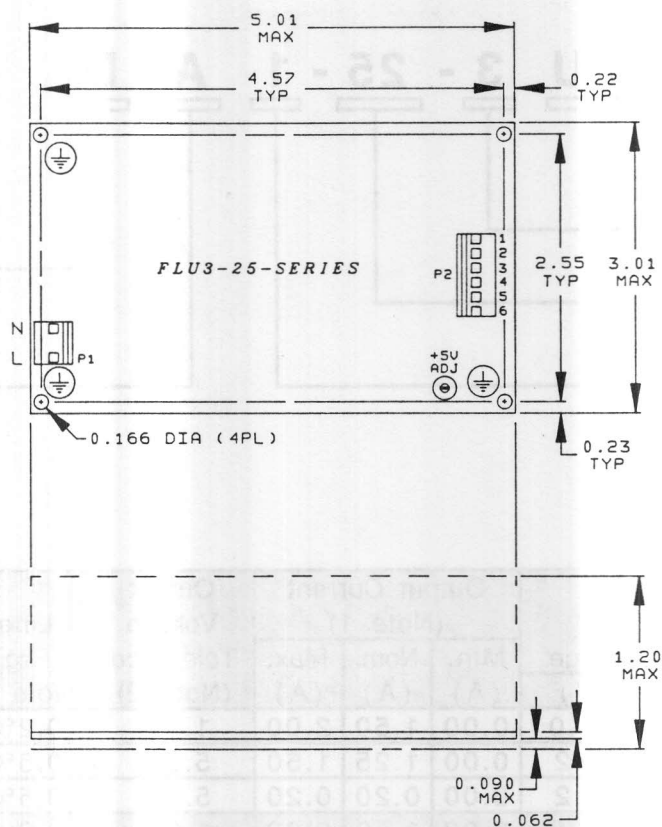
Model Number	Output Voltage		Output Current (Note 1)			Output Voltage Tolerance (Note 2)	Line Reg. (Note 3)	Load Reg. (Note 4)	Cross- Reg. (Note 5)
			Min. (A)	Nom. (A)	Max. (A)				
	Output	(V)							
FLU3-25-1	V1	+5.0	0.00	1.50	2.00	1.0%	0.2%	1.0%	—
	V2	+12	0.00	1.25	1.50	5.0%	0.5%	3.0%	4.0%
	V3	-12	0.00	0.20	0.20	5.0%	0.5%	1.0%	1.0%
FLU3-25-2	V1	+5.0	0.00	1.50	2.00	1.0%	0.2%	1.0%	—
	V2	+12	0.00	1.25	1.50	5.0%	0.5%	3.0%	4.0%
	V3	-5.0	0.00	0.50	0.50	3.0%	0.5%	1.0%	1.0%
FLU3-25-3	V1	+5.0	0.00	1.50	2.00	1.0%	0.2%	1.0%	—
	V2	+15	0.00	1.00	1.20	5.0%	0.5%	3.0%	4.0%
	V3	-15	0.00	0.20	0.20	5.0%	0.5%	1.0%	1.0%
FLU3-25-4	V1	+5.0	0.00	1.50	2.00	1.0%	0.2%	1.0%	—
	V2	+24	0.00	0.65	0.75	5.0%	0.5%	3.0%	4.0%
	V3	-12	0.00	0.20	0.20	5.0%	0.5%	1.0%	1.0%

Notes:

1. The sum of primary and auxiliary load currents must not exceed 3.0A.
2. Output voltage tolerance is measured under nominal load conditions.
3. Line regulation is measured under nominal load conditions with the input voltage varied from 85 to 265 VAC.
4. Load regulation is measured at 115 VAC or 230 VAC input. The output being measured is brought to 60 percent of nominal load; that load current is then varied +40 percent/-30 percent of nominal load. The other output is held at nominal load conditions.
5. Cross-regulation is tested by changing the load on the primary output from 50 percent to 100 percent of nominal load while measuring the voltage change on the auxiliary output.
6. All measurements should be made directly at the terminals of the power supply.

FLU3-25 SERIES

MECHANICAL OUTLINE AND PIN CONFIGURATION



Notes:

1. Dimensions shown are in inches.
2. Tolerances = 0.00 ±0.01
0.000 ±0.005

PIN-OUT

Pin	FLU3-25-1	FLU3-25-2	FLU3-25-3	FLU3-25-4
1	+12V/1.5A	+12V/1.5A	+15V/1.2A	+24V/.075A
2	+5.0V/2.0A	+5.0V/2.0A	+5.0V/2.0A	+5.0V/2.0A
3				
4	COMMON	COMMON	COMMON	COMMON
5				
6	-12V/0.2A	-5.0V/0.5A	-15V/0.2A	-12V/0.2A

CONNECTORS

P1 Input Connector MOLEX 09-74-1031		P2 Output Connector MOLEX 09-74-1061	
Pin 1 AC Neutral	Pin 2 AC Line		
MOLEX Mating Connector		MOLEX Mating Connector	
Housing	09-50-1031	Housing	09-50-1061
Crimp Terminal	08-70-1030	Crimp Terminal	05-70-1030

40W SINGLE OUTPUT SWITCHING POWER SUPPLIES —UNIVERSAL INPUT RANGE, ULTRA-HIGH RELIABILITY—

FEATURES

- Universal Input Voltage Range
- 40 Watts Continuous Output Power
- UL1950 Approved
- CSA C22.2-220 Approved
- Meets VDE0805
- TUV/EN60950/IEC950 Approved
- Austel CCL Certified
- VDE/FCC Class B Input Line Filter
- 0% Minimum Load Requirement
- Over-Current/Short-Circuit Protection
- 2-Year Warranty
- **Minimum 220,000 Hours MTBF**

APPLICATIONS

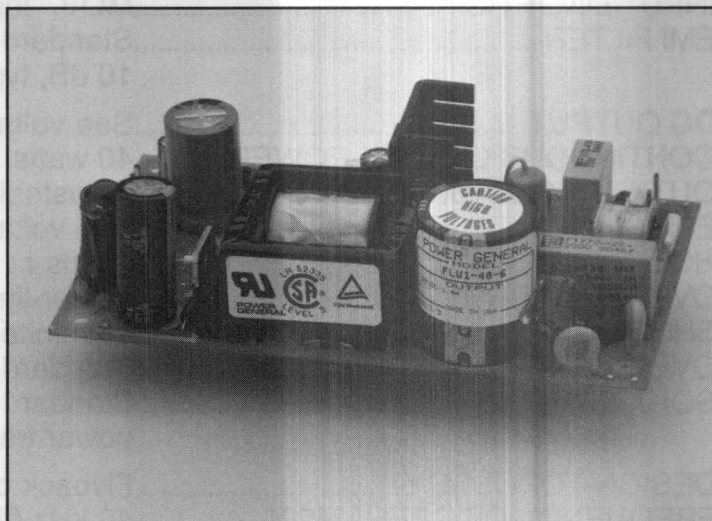
- Data Communications Equipment
- Disk and Tape Drive Subsystems
- Printers
- CRT Terminals

FLU1-40 is a series of single-output, 40-watt, open-frame switching power supplies. Approved to international safety agency standards, these supplies offer high-performance features such as a universal input voltage range of 85 VAC to 265 VAC (or 100-370 VDC) and an on-board EMI filter that complies to VDE/FCC Class B specifications.

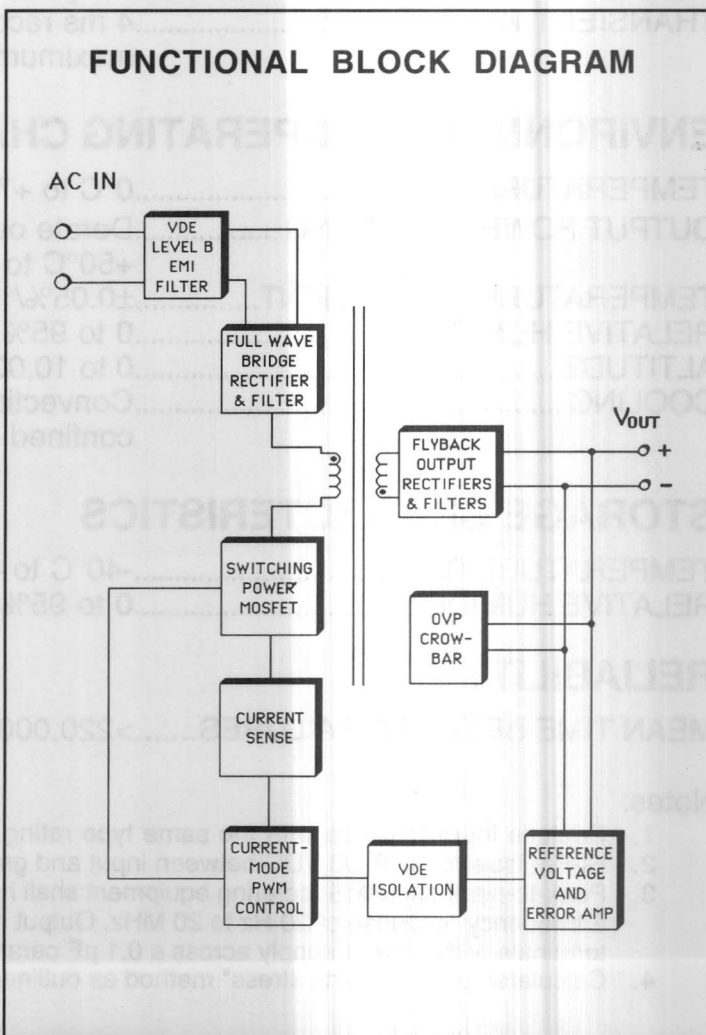
Six models provide dc outputs of 5.0V, 9.0V, 12V, 15V, 24V or 28V. Standard features include 16-millisecond hold-up time, 5300 VDC input/output isolation and an on-board input line fuse. The series provides current limiting, soft start, indefinite short-circuit protection and over-voltage protection. Efficiency is typically greater than 70 percent; line/load regulation is 0.5 percent; the output is adjustable ± 5 percent.

The FLU1-40 series is designed for ultra-high reliability. The minimum MTBF (calculated per the "parts stress" method outlined in MIL-HDBK 217E) is greater than 220,000 hours. Operation is specified over the 0°C to +70°C temperature range with cooling by natural convection.

All models are fabricated on a compact 3.0 x 5.0-inch printed circuit board with a maximum component height of 1.5 inches.



FUNCTIONAL BLOCK DIAGRAM



FLU1-40 SERIES

GENERAL SPECIFICATIONS

AC INPUT	Universal input voltage range 85-265 VAC single phase or 100-370 VDC.
INPUT LINE FREQUENCY	47-63 Hz.
INPUT LINE PROTECTION	MOV. Input line fuse provided on-board. (See Note 1.)
EMI FILTER	Standard. Exceeds requirements of VDE/FCC Class B by 10 dB, typical.
DC OUTPUT	See voltage/current rating chart.
CONTINUOUS OUTPUT POWER	40 watts, maximum.
OUTPUT VOLTAGE ADJUST	Adjustable $\pm 5\%$.
EFFICIENCY	See voltage/current ratings chart.
HOLD-UP TIME	16 ms at 115 VAC, 40 ms at 220 VAC.
OVERLOAD PROTECTION	Power-limit circuit.
SHORT-CIRCUIT PROTECTION	Indefinite.
OVER-VOLTAGE PROTECTION	Standard on all models.
SOFT START	Standard on all models. Prevents output overshoot and power transformer saturation at turn-on.
DESIGN TOPOLOGY	Flyback converter, current-mode control.
FREQUENCY OF OPERATION	40 kHz (fixed).
HI-POT ISOLATION	5300 VDC, input-to-output for one minute. (See Note 2.)
NOISE, RIPPLE and SPIKES	1% peak-to-peak, maximum. (See Note 3.)
TRANSIENT RESPONSE	4 ms recovery to within 1% of regulation band with 5% maximum deviation.

ENVIRONMENTAL OPERATING CHARACTERISTICS

TEMPERATURE RANGE	0°C to +70°C
OUTPUT POWER DERATING	Derate output power and current linearly 2%/°C from +50°C to +70°C.
TEMPERATURE COEFFICIENT	$\pm 0.05\%/^{\circ}\text{C}$ over the entire operating temperature range.
RELATIVE HUMIDITY	0 to 95%, non-condensing.
ALTITUDE	0 to 10,000 feet.
COOLING	Convection cooling is adequate. When operating in a confined area, moving air is recommended.

STORAGE CHARACTERISTICS

TEMPERATURE RANGE	-40°C to +85°C.
RELATIVE HUMIDITY	0 to 95%, non-condensing.

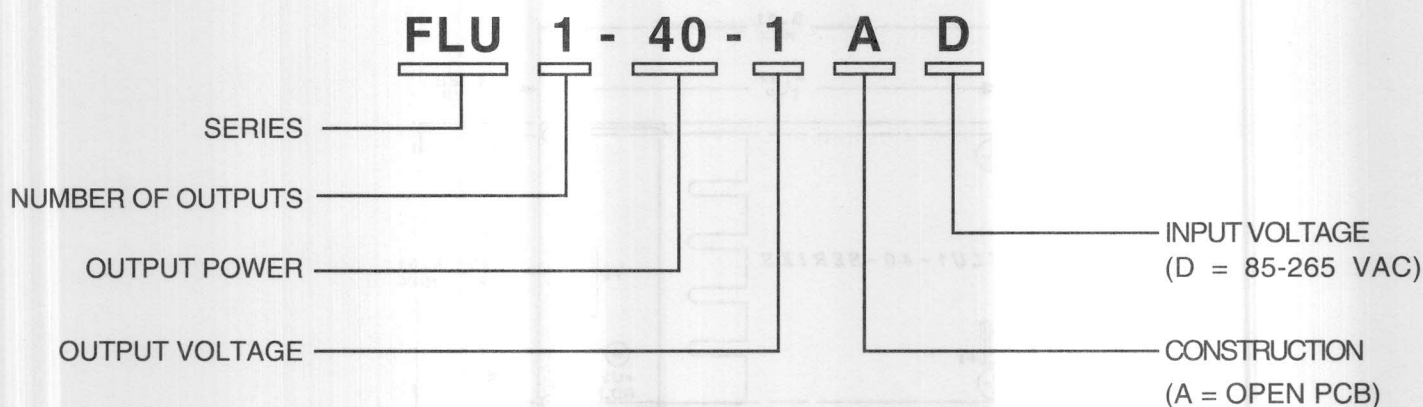
RELIABILITY

MEAN TIME BETWEEN FAILURES.....>220,000 hours. (See Note 4.)

Notes:

1. Replace input line fuse with the same type rating. Recommended: **2.0A/250 VAC slow-blow** fuse.
2. Hi-Pot isolation is 2200 VDC between input and ground for one minute.
3. Peak-to-peak and RMS metering equipment shall have a 20 MHz response with probes and cables maintaining a frequency response of 20 Hz to 20 MHz. Output ripple and spikes are measured directly at the output terminals of the power supply across a 0.1 μF ceramic capacitor without use of the probe ground.
4. Calculated per the "parts stress" method as outlined in MIL-HDBK 217E. Assumes ground benign and +25°C.

MODEL SELECTION GUIDE



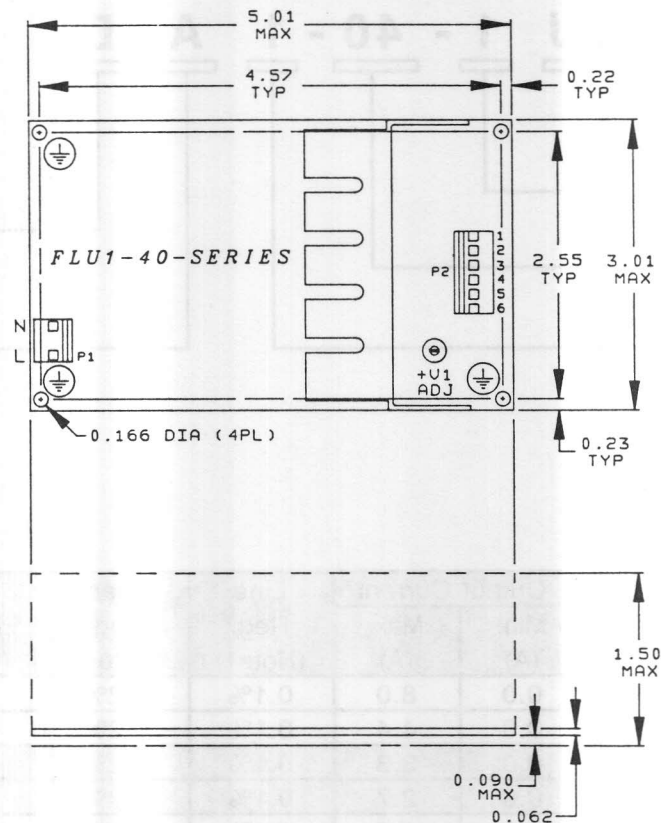
Model Number	Output Voltage (V)	Output Current		Line Reg. (Note 1)	Load Reg. (Note 2)	Efficiency (Note 3)	Output Tolerance (Note 4)
		Min. (A)	Max. (A)				
FLU1-40-1	5.0	0.0	8.0	0.1%	0.2%	62%	±1%
FLU1-40-2	9.0	0.0	4.4	0.1%	0.2%	68%	±1%
FLU1-40-3	12	0.0	3.3	0.1%	0.2%	72%	±1%
FLU1-40-4	15	0.0	2.7	0.1%	0.2%	72%	±1%
FLU1-40-5	24	0.0	1.7	0.1%	0.2%	75%	±1%
FLU1-40-6	28	0.0	1.4	0.1%	0.2%	75%	±1%

Notes:

1. Line regulation is measured under nominal load conditions with the input voltage varied from 85 VAC to 265 VAC.
2. Load regulation is tested by varying the load from 0% to 100% of rated load..
3. Efficiency is measured under full load at nominal input line.
4. Output tolerance is measured under maximum load conditions.
5. All measurements should be made directly at the terminals of the power supply.
6. The FLU1-40 series is approved to UL1950 (File E76127), CSA C22.2-220 (File No. LR52335), EN60950/IEC950 (TUV License R97678 and R9071501), and is Austel CCL-certified (Certificate A92/PS/004). VDE0805 approval is pending.

FLU1-40 SERIES

MECHANICAL OUTLINE AND PIN CONFIGURATION



Notes:

1. Dimensions shown are in inches.
2. Tolerances = 0.00 ±0.01
0.000 ±0.005

PIN-OUT

Pin	FLU1-40-1	FLU1-40-2	FLU1-40-3	FLU1-40-4	FLU1-40-5	FLU1-40-6
1						
2	5.0V/8.00A	9.0V/4.45A	12V/3.35A	15V/2.70A	24V/1.70A	28V/1.45A
3						
4						
5	COMMON	COMMON	COMMON	COMMON	COMMON	COMMON
6						

CONNECTORS

P1 Input Connector		P2 Output Connector	
MOLEX 09-74-1031		MOLEX 09-74-1061	
Pin	Function		
1	AC Neutral		
2	AC Return		
MOLEX Mating Connector		MOLEX Mating Connector	
Housing	09-50-1031	Housing	09-50-1061
Crimp Terminal	08-70-1030	Crimp Terminal	08-70-1030

40W DUAL OUTPUT SWITCHING POWER SUPPLIES —UNIVERSAL INPUT RANGE, ULTRA-HIGH RELIABILITY—

FEATURES

- Universal Input Voltage Range
- 40 Watts Continuous Output Power
- UL1950 Approved
- CSA C22.2-220/C22.2-950 Approved
- Meets VDE0805
- TUV/EN60950/IEC950 Approved
- Austel CCL Certified
- VDE/FCC Class B Input Line Filter
- 0% Minimum Load on Both Outputs
- Over-Current/Short-Circuit Protection
- 2-Year Warranty
- **Demonstrated 5,000,000 Hours MTBF**

APPLICATIONS

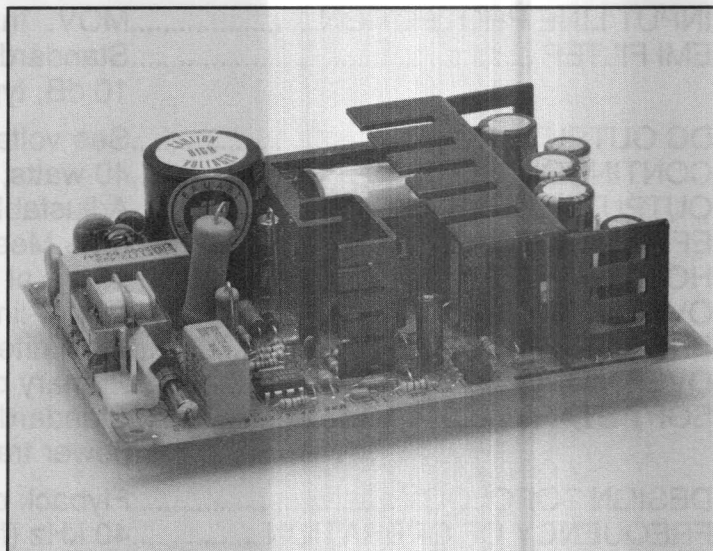
- Data Communications Equipment
- Disk and Tape Drive Subsystems
- Microcomputer Based Systems
- CRT Terminals

FLU2-40 is a series of two-output, 40-watt, open-frame switching power supplies. Approved to international safety agency standards, these supplies offer high-performance features such as a universal input voltage range of 85 VAC to 265 VAC (or 100-370 VDC) and an on-board EMI filter that complies with VDE/FCC Class B specifications.

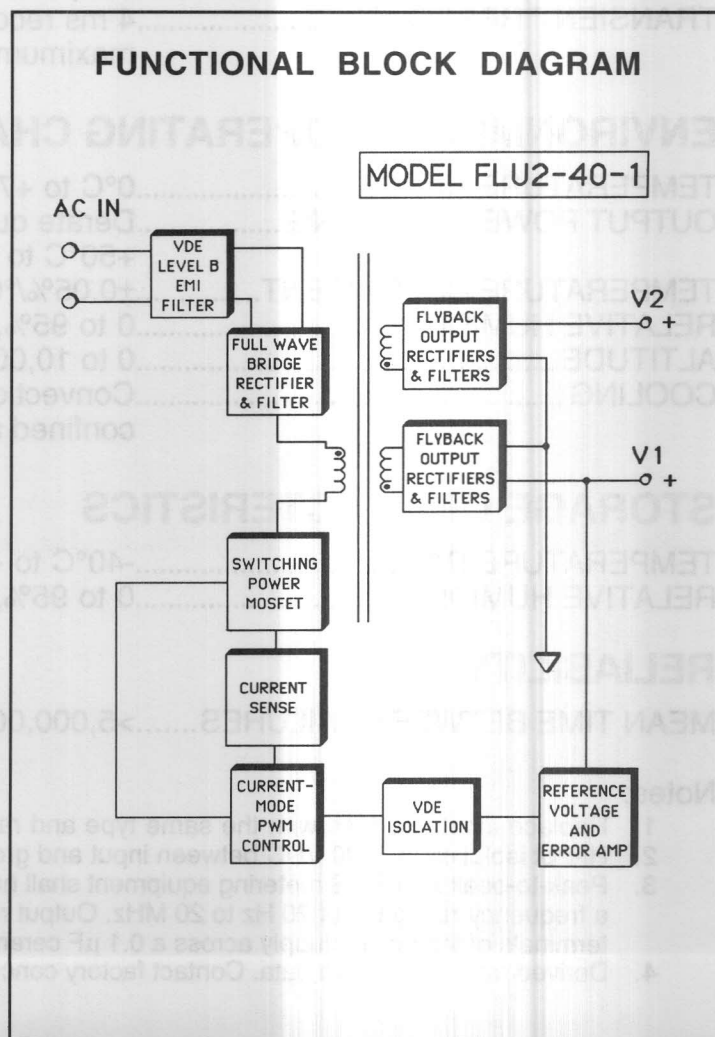
Seven models provide output combinations of +5 and +12, +15, +24 or +28 VDC and dual isolated 5, 12 or 15 VDC outputs. Standard features include 16-millisecond hold-up time, 5300 VDC input/output isolation and an on-board input line fuse. Other features include soft start, current limiting, indefinite short-circuit and over-voltage protection. The transient load capability of the outputs make the FLU2-40 an ideal choice for applications with pulsed loads, such as disk or tape drives and other electro-mechanical devices.

The FLU2-40 series is designed to achieve ultra-high reliability. The minimum MTBF (demonstrated from actual field data) is greater than 5,000,000 hours. Operation is specified over the 0° to +70°C temperature range with cooling by natural convection.

All models are fabricated on a compact 3.0 x 5.0-inch printed circuit board with a maximum component height of 1.5 inches.



FUNCTIONAL BLOCK DIAGRAM



FLU2-40 SERIES

GENERAL SPECIFICATIONS

AC INPUT	Universal input voltage range 85-265 VAC single phase or 100-370 VDC.
INPUT LINE FREQUENCY	47-63 Hz.
INPUT LINE PROTECTION	MOV. Input line fuse provided on-board. (See Note 1.)
EMI FILTER	Standard. Exceeds requirements of VDE/FCC Class B by 10 dB, typical.
DC OUTPUT	See voltage/current rating chart.
CONTINUOUS OUTPUT POWER	40 watts, maximum.
OUTPUT VOLTAGE ADJUST	Adjustable $\pm 5\%$, primary output only.
EFFICIENCY	65% Measured at full load and nominal input line.
HOLD-UP TIME	16 ms at 115 VAC, 40 ms at 220 VAC.
OVERLOAD PROTECTION	Power-limit circuit.
SHORT-CIRCUIT PROTECTION	Indefinite.
OVER-VOLTAGE PROTECTION	Primary output only.
SOFT START	Standard on all models. Prevents output overshoot and power transformer saturation at turn-on.
DESIGN TOPOLOGY	Flyback converter, current-mode control.
FREQUENCY OF OPERATION	40 kHz (fixed).
HI-POT ISOLATION	5300 VDC, input-to-output for one minute. (See Note 2.)
NOISE, RIPPLE and SPIKES	1% peak-to-peak, maximum. (See Note 3.)
TRANSIENT RESPONSE	4 ms recovery to within 1% of regulation band with 5% maximum deviation.

ENVIRONMENTAL OPERATING CHARACTERISTICS

TEMPERATURE RANGE	0°C to +70°C
OUTPUT POWER DERATING	Derate output power and current linearly 2%/°C from +50°C to +70°C.
TEMPERATURE COEFFICIENT	$\pm 0.05\%$ /°C over the entire operating temperature range.
RELATIVE HUMIDITY	0 to 95%, non-condensing.
ALTITUDE	0 to 10,000 feet.
COOLING	Convection cooling is adequate. When operating in a confined area, moving air is recommended.

STORAGE CHARACTERISTICS

TEMPERATURE RANGE	-40°C to +85°C.
RELATIVE HUMIDITY	0 to 95%, non-condensing.

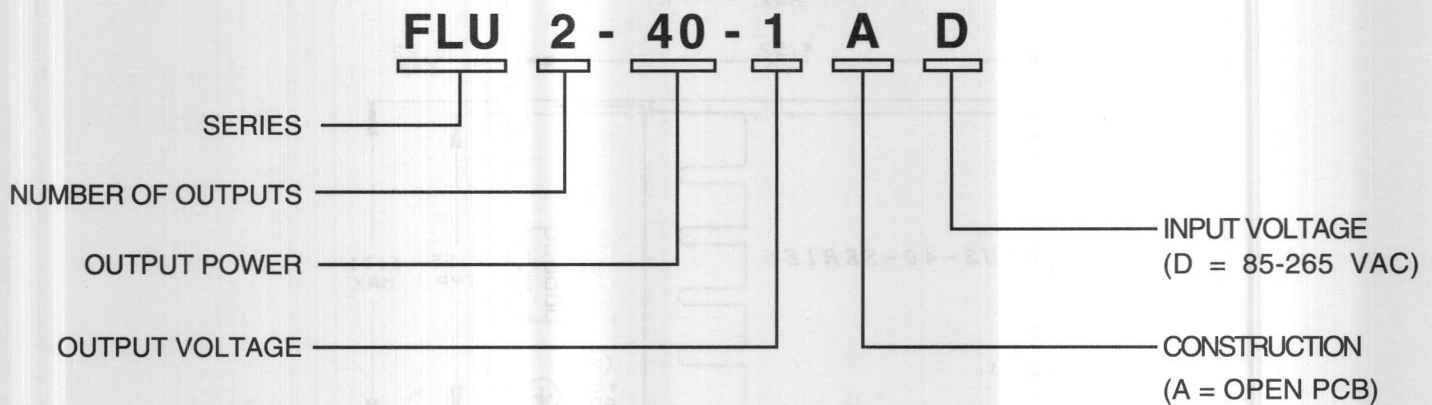
RELIABILITY

MEAN TIME BETWEEN FAILURES.....>5,000,000 hours, demonstrated. (See Note 4.)

Notes:

1. Replace input line fuse with the same type and rating. Recommended: **2.0A/250 VAC slow-blow fuse.**
2. Hi-Pot isolation is 2200 VDC between input and ground for one minute.
3. Peak-to-peak and RMS metering equipment shall have a 20 MHz response with probes and cables maintaining a frequency response of 20 Hz to 20 MHz. Output ripple and spikes are measured directly at the output terminals of the power supply across a 0.1 μ F ceramic capacitor without use of the probe ground.
4. Derived from actual field data. Contact factory concerning methodology and data.

MODEL SELECTION GUIDE



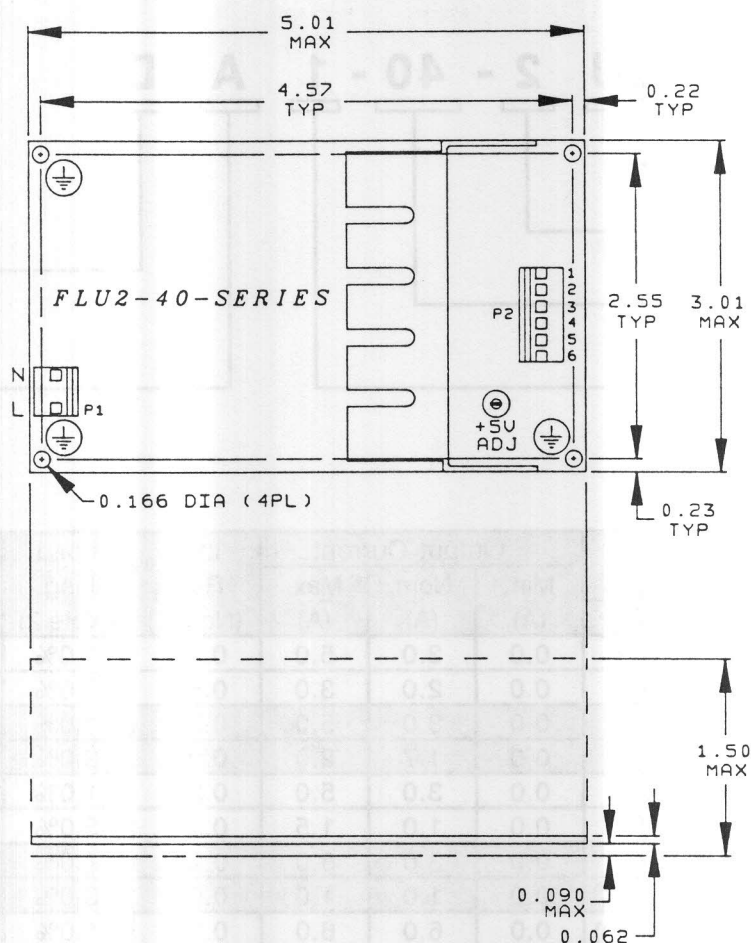
Model Number	Output Voltage		Output Current			Line Reg. (Note 1)	Load Reg. (Note 2)	Cross-Reg. (Note 3)	Output Tolerance (Note 4)
	Output	(V)	Min. (A)	Nom. (A)	Max. (A)				
FLU2-40-1	V1	+5.0	0.0	3.0	5.0	0.2%	1.0%	—	±1%
	V2	+12	0.0	2.0	3.0	0.5%	3.0%	4.0%	±5%
FLU2-40-2	V1	+5.0	0.0	3.0	5.0	0.2%	1.0%	—	±1%
	V2	+15	0.0	1.7	2.0	0.2%	3.0%	4.0%	±5%
FLU2-40-3	V1	+5.0	0.0	3.0	5.0	0.2%	1.0%	—	±1%
	V2	+24	0.0	1.0	1.5	0.2%	3.0%	4.0%	±5%
FLU2-40-4	V1	+5.0	0.0	3.0	5.0	0.2%	1.0%	—	±1%
	V2	+28	0.0	1.0	1.0	0.5%	3.0%	4.0%	±5%
FLU2-40-5	V1	5.0 (ISO)	0.0	6.0	6.0	0.2%	1.0%	—	±1%
	V2	5.0 (ISO)	0.0	2.0	2.0	0.5%	1.0%	1.0%	±3%
FLU2-40-6	V1	12 (ISO)	0.0	2.0	3.0	0.2%	1.0%	—	±1%
	V2	12 (ISO)	0.0	1.0	2.0	0.5%	1.0%	1.0%	±3%
FLU2-40-7	V1	15 (ISO)	0.0	1.5	2.5	0.2%	1.0%	—	±1%
	V2	15 (ISO)	0.0	1.2	2.0	0.5%	1.0%	1.0%	±3%

Notes:

- Line regulation is measured under nominal load conditions with the input voltage varied from 85 VAC to 265 VAC.
- Load regulation is measured at 115 VAC or 230 VAC input, while the output being measured is loaded to 60% of nominal load and varied +40%/-30%. The other outputs are nominally loaded.
- Cross-regulation is measured by changing the load on the primary output (V1) from 50% to 100% of nominal load while measuring the voltage change on the auxiliary output.
- Output tolerance is measured under nominal load conditions.
- All measurements should be made directly at the terminals of the power supply.
- The FLU2-40 series is approved to UL1950 (File E76127), CSA C22.2-220 (File No. LR52335), EN60950/IEC950 (TUV License R97678 and R9071501), and is Austel CCL certified (Certificate A92/PS/004). VDE0805 approval is pending.

FLU2-40 SERIES

MECHANICAL OUTLINE AND PIN CONFIGURATION



Notes:

1. Dimensions shown are in inches.
2. Tolerances = 0.00 ±0.01
0.000 ±0.005

PIN-OUT

Pin	FLU2-40-1	FLU2-40-2	FLU2-40-3	FLU2-40-4	FLU2-40-5	FLU2-40-6	FLU2-40-7
1	+12V/3.0A	+15V/2.0A	+24V/1.5A	+28V/1.0A	+ V1	+ V1	+ V1
2	+5.0V/5.0A	+5.0V/5.0A	+5.0V/5.0A	+5.0V/5.0A			
3	+5.0V/5.0A	+5.0V/5.0A	+5.0V/5.0A	+5.0V/5.0A	- V1	- V1	- V1
4	COMMON	COMMON	COMMON	COMMON			
5	COMMON	COMMON	COMMON	COMMON	- V2	- V2	- V2
6	N/C	N/C	N/C	N/C	+ V2	+ V2	+ V2

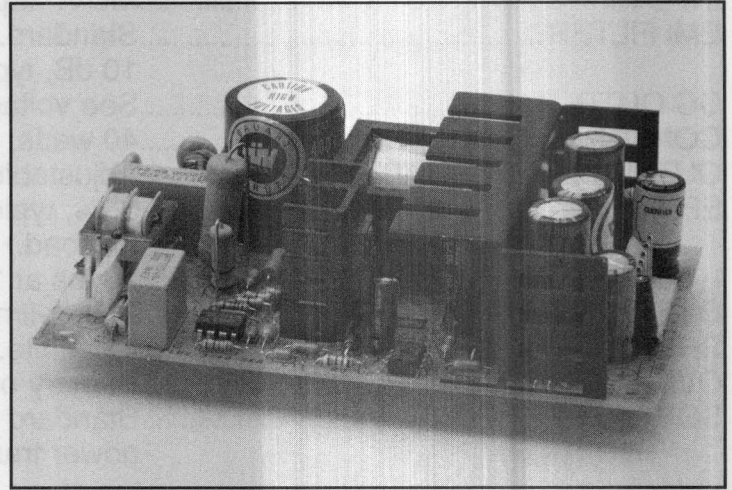
CONNECTORS

P1 Input Connector MOLEX 09-74-1031		P2 Output Connector MOLEX 09-74-1061	
Pin 1 AC Neutral	Pin 2 AC Line		
MOLEX Mating Connector		MOLEX Mating Connector	
Housing	09-50-1031	Housing	09-50-1061
Crimp Terminal	08-70-1030	Crimp Terminal	08-70-1030

40W TRIPLE OUTPUT SWITCHING POWER SUPPLIES —UNIVERSAL INPUT RANGE, ULTRA-HIGH RELIABILITY—

FEATURES

- Universal Input Voltage Range
- 40 Watts Continuous Output Power
- UL1950 Approved
- CSA C22.2-220 Approved
- Meets VDE0805
- TUV/EN60950/IEC950 Approved
- Austel CCL Certified
- VDE/FCC Class B Input Line Filter
- 0% Minimum Load on All Outputs
- Over-Current/Short-Circuit Protection
- 2-Year Warranty
- **Demonstrated 5,000,000 Hours MTBF**



APPLICATIONS

- Data Communications Equipment
- Disk and Tape Drive Subsystems

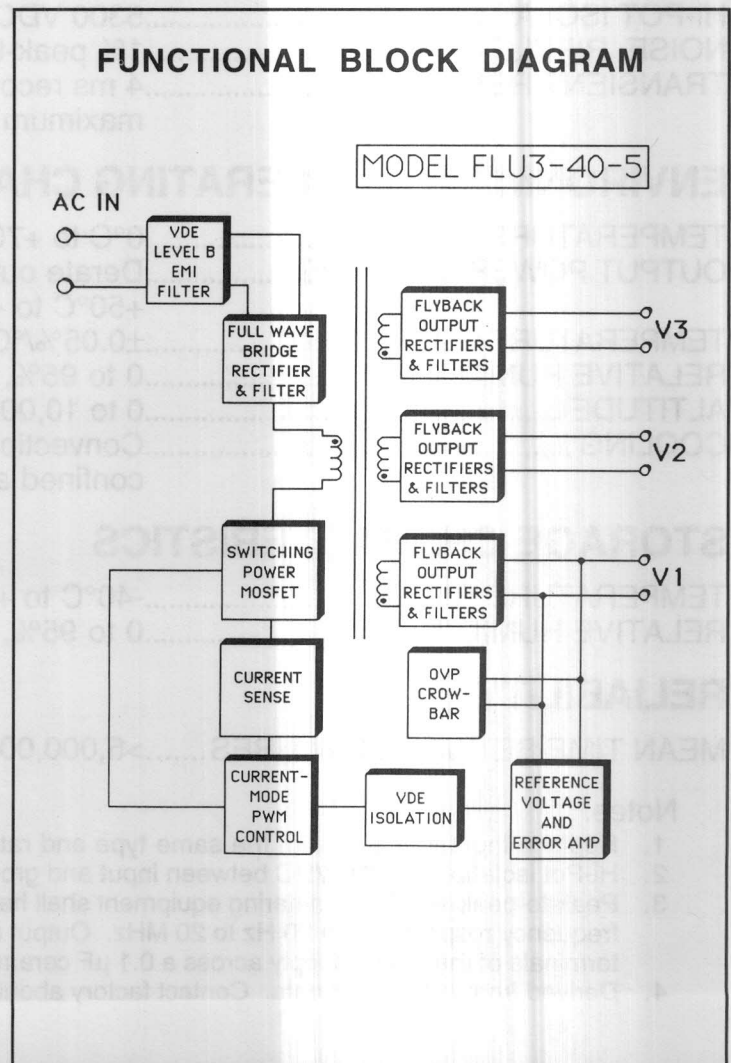
FLU3-40 is a series of triple-output, 40-watt, open-frame switching power supplies. Approved to international safety agency standards, these supplies offer high-performance features such as a universal input voltage range of 85 VAC to 265 VAC (or 100-370 VDC) and an on-board EMI filter that complies to VDE/FCC Class B specifications.

Six models provide outputs of +5.0 VDC and combinations of $\pm 12V$, $\pm 15V$, or $-5VDC$ and +24 V. Standard features include 16-millisecond hold-up time, 5300 VDC input/output isolation and an on-board input line fuse. The series provides soft start, indefinite short-circuit protection, over-voltage protection and current limiting. Efficiency is 70 percent; load regulation is 1 percent; the primary output is adjustable ± 5 percent. The transient load capability of the +12/+24 VDC outputs make the FLU3-40 series an ideal choice for applications with pulsed loads such as disk/tape drives and other electro-mechanical devices.

The FLU3-40 series is designed for ultra-high reliability. The minimum MTBF (demonstrated from actual field data) is 5,000,000 hours. Operation is specified over the temperature range of $0^{\circ}C$ to $+70^{\circ}C$ with cooling by natural convection.

All models are fabricated on a compact 3.0 x 5.0-inch printed circuit board with a maximum component height of 1.5 inches.

FUNCTIONAL BLOCK DIAGRAM



FLU3-40 SERIES

GENERAL SPECIFICATIONS

AC INPUT	Universal input voltage range 85-265 VAC single phase or 100-370 VDC.
INPUT LINE FREQUENCY	47-63 Hz.
INPUT LINE PROTECTION	MOV. Input line fuse provided on-board. (See Note 1.)
EMI FILTER	Standard. Exceeds requirements of VDE/FCC Class B by 10 dB, typical.
DC OUTPUT	See voltage/current rating chart.
CONTINUOUS OUTPUT POWER	40 watts, maximum.
OUTPUT VOLTAGE ADJUST	Adjustable $\pm 5\%$, primary output only.
EFFICIENCY	65%, typical. (Nominal input voltage line conditions and full load.)
HOLD-UP TIME	16 ms at 115 VAC; 40 ms at 220 VAC.
OVERLOAD PROTECTION	Power-limit circuit.
SHORT-CIRCUIT PROTECTION	Indefinite.
OVER-VOLTAGE PROTECTION	Primary output only.
SOFT START	Standard on all models. Prevents output overshoot and power transformer saturation at turn-on.
DESIGN TOPOLOGY	Flyback converter, current-mode control.
FREQUENCY OF OPERATION	40 kHz (fixed).
HI-POT ISOLATION	5300 VDC, input-to-output for one minute. (See Note 2.)
NOISE, RIPPLE & SPIKES	1% peak-to-peak, maximum (See Note 3.)
TRANSIENT RESPONSE	4 ms recovery to within 1% of regulation band with 5% maximum deviation.

ENVIRONMENTAL OPERATING CHARACTERISTICS

TEMPERATURE RANGE	0°C to +70°C.
OUTPUT POWER DERATING	Derate output power and current linearly 2%/°C from +50°C to +70°C.
TEMPERATURE COEFFICIENT	$\pm 0.05\%/^{\circ}\text{C}$ over the entire operating temperature range.
RELATIVE HUMIDITY	0 to 95%, non-condensing.
ALTITUDE	0 to 10,000 feet.
COOLING	Convection cooling is adequate. When operating in a confined area, moving air is recommended.

STORAGE CHARACTERISTICS

TEMPERATURE RANGE	-40°C to +85°C.
RELATIVE HUMIDITY	0 to 95%, non-condensing.

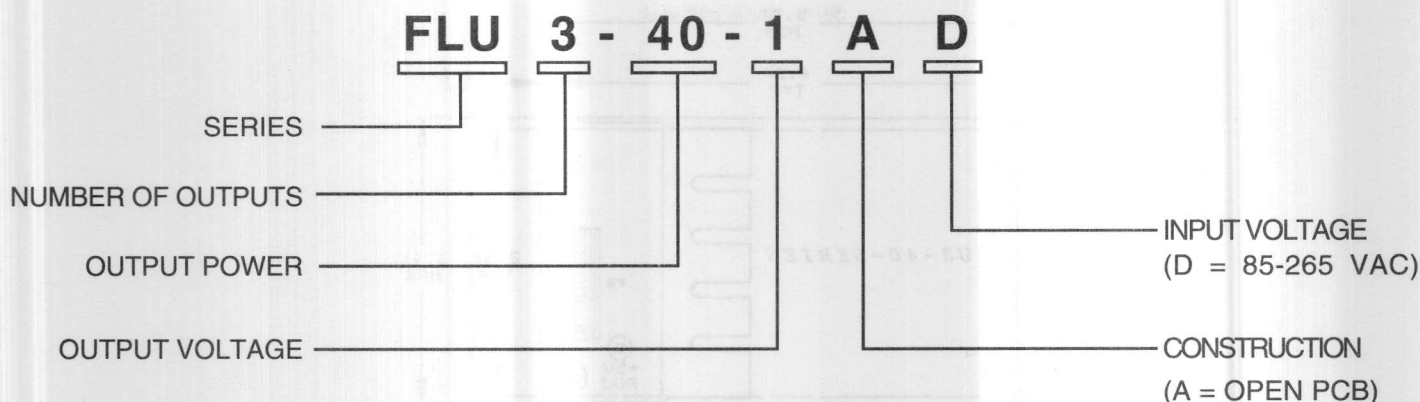
RELIABILITY

MEAN TIME BETWEEN FAILURES.....>5,000,000 hours, demonstrated. (See Note 4.)

Notes:

1. Replace input line fuse with the same type and rating. Recommended: **2.0A/250 VAC slow blow** fuse.
2. Hi-Pot isolation is 2200 VDC between input and ground for one minute.
3. Peak-to-peak and RMS metering equipment shall have a 20 MHz response with probes and cables maintaining frequency response from 20 Hz to 20 MHz. Output ripple and spikes are measured directly at the output terminals of the power supply across a 0.1 μF ceramic capacitor without use of the probe ground.
4. Derived from actual field data. Contact factory about methodology and data.

MODEL SELECTION GUIDE



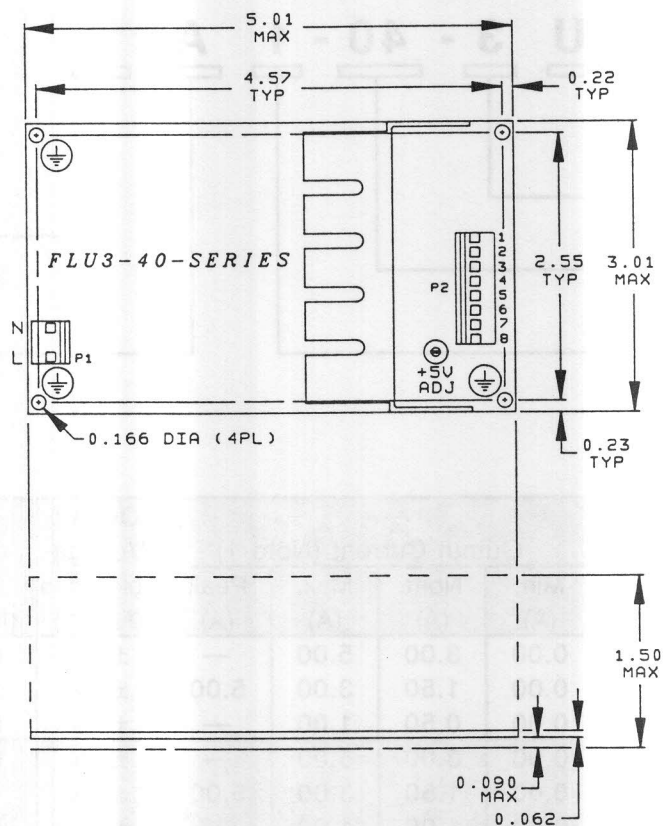
Model Number	Output Voltage		Output Current (Note 1)				Output Voltage Tolerance (Note 2)	Line Reg. (Note 3)	Load Reg. (Note 4)	Cross-Reg. (Note 5)
			Min. (A)	Nom. (A)	Max. (A)	Peak (A)				
FLU3-40-1	V1	+5.0	0.00	3.00	5.00	—	±1%	0.2%	1.0%	—
	V2	+12	0.00	1.50	3.00	5.00	±5%	1.0%	3.0%	4.0%
	V3	-12	0.00	0.50	1.00	—	±5%	0.2%	1.0%	1.0%
FLU3-40-2	V1	+5.0	0.00	3.00	5.00	—	±1%	0.2%	1.0%	—
	V2	+12	0.00	1.50	3.00	5.00	±5%	1.0%	3.0%	4.0%
	V3	-5.0	0.00	1.00	1.00	—	±3%	0.2%	1.0%	1.0%
FLU3-40-3	V1	+5.0	0.00	3.00	5.00	—	±1%	0.2%	1.0%	—
	V2	+15	0.00	1.20	2.00	3.00	±5%	1.0%	3.0%	4.0%
	V3	-15	0.00	0.50	1.00	—	±5%	0.2%	1.0%	1.0%
FLU3-40-4	V1	+5.0	0.00	3.00	5.00	—	±1%	0.2%	1.0%	—
	V2	+24	0.00	0.75	1.50	2.00	±5%	1.0%	3.0%	4.0%
	V3	-12	0.00	0.50	1.00	—	±5%	0.2%	1.0%	1.0%
FLU3-40-5	V1	5.0 (ISO)	0.00	5.00	6.00	—	±1%	0.2%	0.5%	—
	V2	12 (ISO)	0.00	0.30	0.50	—	±3%	0.5%	1.0%	1.0%
	V3	12 (ISO)	0.00	0.30	0.50	—	±3%	0.5%	1.0%	1.0%
FLU3-40-6	V1	5.0 (ISO)	0.00	5.00	6.00	—	±1%	0.2%	0.5%	—
	V2	15 (ISO)	0.00	0.30	0.50	—	±3%	0.5%	1.0%	1.0%
	V3	15 (ISO)	0.00	0.30	0.50	—	±3%	0.5%	1.0%	1.0%

Notes:

1. The sum of the +5 VDC primary and auxiliary load currents must not exceed 5.0A for models FLU3-40-1 to -4.
2. Output voltage tolerance is measured under nominal load conditions.
3. Line regulation is measured under nominal load conditions with the input voltage varied from 85 to 265 VAC.
4. Load regulation is measured at 115 VAC or 230 VAC input, while the output being measured is loaded to 60% of nominal load and varied +40%/-30%. The other outputs are nominally loaded.
5. Cross-regulation is measured by changing the load on the primary output (V1) from 50% to 100% of nominal load while measuring the voltage change on the auxiliary output.
6. All measurements should be made directly at the terminals of the power supply.
7. The FLU3-40 series is approved to UL1950 (File E76127), CSA C22.2-220 (File LR52335), EN60950/IEC950 (TUV License R97678 and R9071501), and is certified by Austel (Certificate A92/PS/004). VDE0805 approval is pending.

FLU3-40 SERIES

MECHANICAL OUTLINE AND PIN CONFIGURATION



Notes:

1. Dimensions shown are in inches.
2. Tolerances = 0.00 ±0.01
0.000 ±0.005

PIN-OUT

Pin	FLU3-40-1	FLU3-40-2	FLU3-40-3	FLU3-40-4	FLU3-40-5	FLU3-40-6
1	V2	V2	V2	V2	+ V2	+ V2
2	V1	V1	V1	V1	- V2	- V2
3	V1	V1	V1	V1	+ V1	+ V1
4	COMMON	COMMON	COMMON	COMMON	- V1	- V1
5	COMMON	COMMON	COMMON	COMMON		
6	V3	V3	V3	V3	- V3	- V3
7	N/A	N/A	N/A	N/A	+ V3	+ V3
8	N/A	N/A	N/A	N/A		

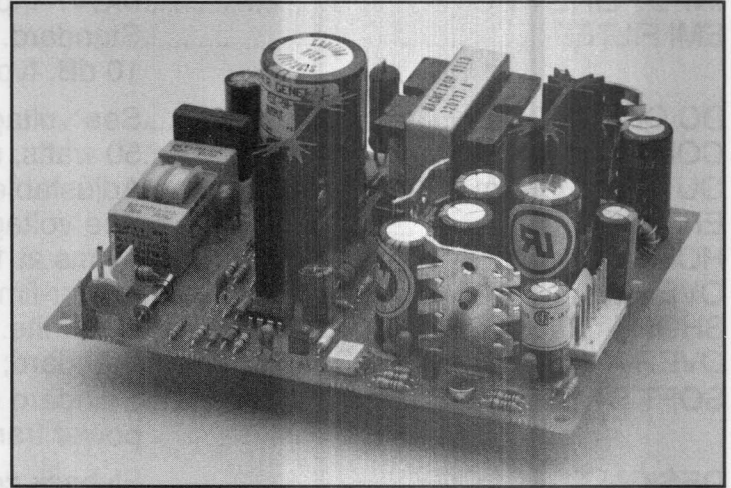
CONNECTORS

<u>P1 Input Connector</u>		<u>P2 Output Connector</u>		<u>P2 Output Connector</u>	
MOLEX 09-74-1031		Models 1 through 4		Models 5 & 6	
<u>Pin</u>	<u>Function</u>				
1	AC Neutral	MOLEX 09-74-1061		MOLEX 09-74-1081	
2	AC Line				
MOLEX Mating Connector		MOLEX Mating Connector		MOLEX Mating Connector	
Housing	09-50-1031	Housing	09-50-1061	Housing	09-50-1081
Crimp Terminal	08-70-1030	Crimp		Crimp	
		Terminal	08-70-1030	Terminal	08-70-1030

50W SINGLE OUTPUT SWITCHING POWER SUPPLIES —UNIVERSAL INPUT RANGE, ULTRA-HIGH RELIABILITY—

FEATURES

- Universal Input Voltage Range
- 50 Watts Continuous Output Power
- Meets UL1950
- CSA C22.2-220 Approved
- Meets VDE0805
- Meets EN60950/IEC950
- VDE/FCC Class B Input Line Filter
- 0% Minimum Load Requirement
- Over-Current/Short-Circuit Protection
- 2-Year Warranty
- **Minimum 205,000 Hours MTBF**



APPLICATIONS

- Data Communications Equipment
- Disk and Tape Drive Subsystems
- Printers
- CRT Terminals

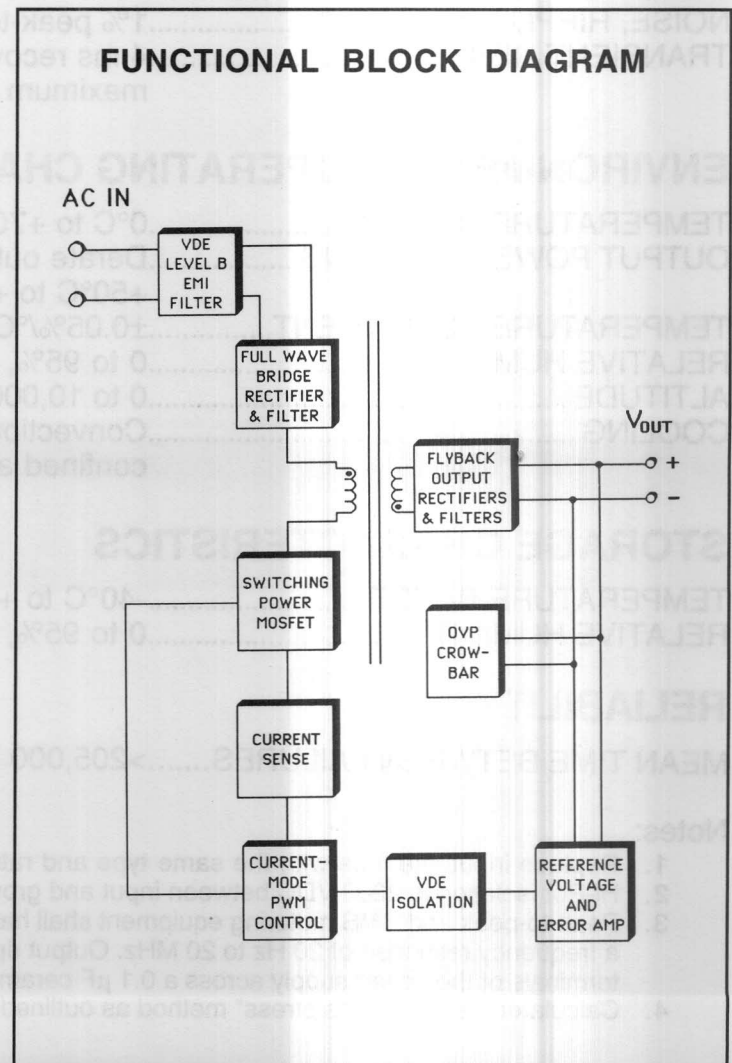
FLU1-50 is a series of single-output, 50-watt, open-frame switching power supplies. Designed to meet international safety agency standards, including those of VDE, IEC, UL and CSA, these supplies offer high-performance features such as a universal input voltage range of 85 VAC to 265 VAC (or 100-370 VDC) and an on-board EMI filter that complies to VDE/FCC Class B specifications.

Six models provide dc output of 5.0V, 9.0V, 12V, 15V, 24V or 28V. Standard features include 16-millisecond hold-up time, 5300 VDC input/output isolation and an on-board input line fuse. The series provides current limiting, soft start, indefinite short-circuit protection and over-voltage protection. Line/load regulation is ± 0.5 percent.

The FLU1-50 series is designed for ultra-high reliability. The minimum MTBF (calculated per the "parts stress" method outlined in MIL-HDBK 217E) is 205,000 hours. Operation is specified over the 0°C to +70°C temperature range with cooling by natural convection.

All models are fabricated on a compact 3.0 x 5.0-inch printed circuit board with a maximum component height of 1.75 inches.

FUNCTIONAL BLOCK DIAGRAM



FLU1-50 SERIES

GENERAL SPECIFICATIONS

AC INPUT	Universal input voltage range 85-265 VAC single phase or 100-370 VDC.
INPUT LINE FREQUENCY	47-63 Hz.
INPUT LINE PROTECTION	MOV. Input line fuse provided on-board. (See Note 1.)
EMI FILTER	Standard. Exceeds requirements of VDE/FCC Class B by 10 dB, typical.
DC OUTPUT	See voltage/current rating chart.
CONTINUOUS OUTPUT POWER	50 watts, maximum.
OUTPUT VOLTAGE ADJUST	Adjustable $\pm 5\%$.
EFFICIENCY	See voltage/current ratings chart.
HOLD-UP TIME	16 ms at 115 VAC, typical.
OVERLOAD PROTECTION	Power-limit circuit.
SHORT-CIRCUIT PROTECTION	Indefinite.
OVER-VOLTAGE PROTECTION	Standard; crowbar type (120% of V_{OUT} , typical).
SOFT START	Standard on all models. Prevents output overshoot and power transformer saturation at turn-on.
DESIGN TOPOLOGY	Flyback converter, current-mode control.
FREQUENCY OF OPERATION	40 kHz (fixed).
HI-POT ISOLATION	5300 VDC, input-to-output for one minute. (See Note 2.)
NOISE, RIPPLE and SPIKES	1% peak-to-peak, maximum. (See Note 3.)
TRANSIENT RESPONSE	4 ms recovery to within 1% of regulation band with 5% maximum deviation.

ENVIRONMENTAL OPERATING CHARACTERISTICS

TEMPERATURE RANGE	0°C to +70°C
OUTPUT POWER DERATING	Derate output power and current linearly 2%/°C from +50°C to +70°C.
TEMPERATURE COEFFICIENT	$\pm 0.05\%/^{\circ}\text{C}$ over the entire operating temperature range.
RELATIVE HUMIDITY	0 to 95%, non-condensing.
ALTITUDE	0 to 10,000 feet.
COOLING	Convection cooling is adequate. When operating in a confined area, moving air is recommended.

STORAGE CHARACTERISTICS

TEMPERATURE RANGE	-40°C to +85°C.
RELATIVE HUMIDITY	0 to 95%, non-condensing.

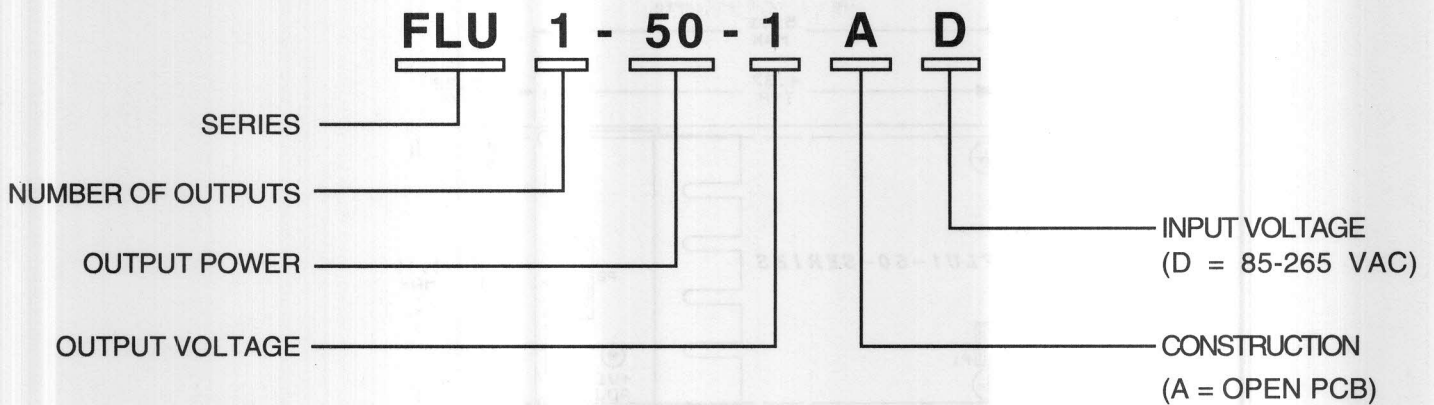
RELIABILITY

MEAN TIME BETWEEN FAILURES.....>205,000 Hours. (See Note 4.)

Notes:

1. Replace input line fuse with the same type and rating. Recommended: **2.0A/250 VAC slow-blow** fuse.
2. Hi-Pot isolation is 2200 VDC between input and ground for one minute.
3. Peak-to-peak and RMS metering equipment shall have a 20 MHz response with probes and cables maintaining a frequency response of 20 Hz to 20 MHz. Output ripple and spikes are measured directly at the output terminals of the power supply across a 0.1 μF ceramic capacitor without use of the probe ground.
4. Calculated per the "parts stress" method as outlined in MIL-HDBK 217E. Assumes ground benign and +25°C.

MODEL SELECTION GUIDE



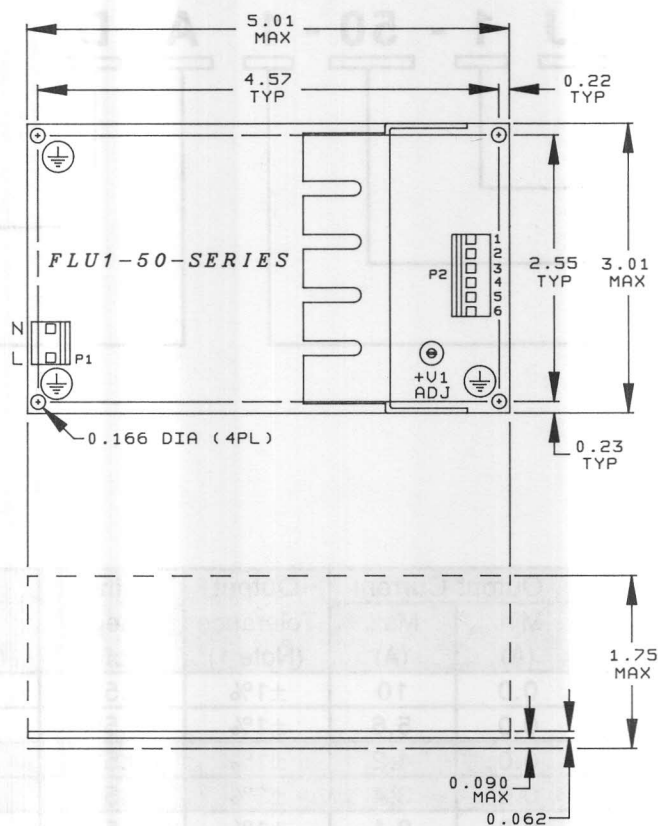
Model Number	Output Voltage (V)	Output Current		Output Tolerance (Note 1)	Line Reg. (Note2)	Load Reg. (Note 3)	Efficiency (Note 4)
		Min. (A)	Max. (A)				
FLU1-50-1	5.0	0.0	10	±1%	0.5%	0.5%	62%
FLU1-50-2	9.0	0.0	5.6	±1%	0.5%	0.5%	65%
FLU1-50-3	12	0.0	4.2	±1%	0.5%	0.5%	68%
FLU1-50-4	15	0.0	3.4	±1%	0.5%	0.5%	72%
FLU1-50-5	24	0.0	2.1	±1%	0.5%	0.5%	72%
FLU1-50-6	28	0.0	1.8	±1%	0.5%	0.5%	75%

Notes:

1. Output voltage tolerance is measured under nominal load conditions.
2. Line regulation is measured under nominal load conditions with the input voltage varied from 85 to 265 VAC.
3. Load regulation is measured at 115 VAC or 230 VAC input, while the output load is varied 0-100%.
4. Efficiency is measured under full load at nominal input line.
5. All measurements should be made directly at the terminals of the power supply.

FLU1-50 SERIES

MECHANICAL OUTLINE AND PIN CONFIGURATION



Notes:

1. Dimensions shown are in inches.
2. Tolerances = 0.00 ± 0.01
 0.000 ± 0.005

PIN-OUT

Pin	FLU1-50-1	FLU1-50-2	FLU1-50-3	FLU1-50-4	FLU1-50-5	FLU1-50-6
1	5.0V/10A	9.0V/5.6A	12V/4.2A	15V/3.3A	24V/2.1A	28V/1.8A
2						
3						
4	RETURN	RETURN	RETURN	RETURN	RETURN	RETURN
5						
6						

CONNECTORS

P1 Input Connector		P2 Output Connector	
MOLEX 09-74-1031		MOLEX 09-74-1061	
Pin	Function		
1	AC Neutral		
2	AC Line		
MOLEX Mating Connector		MOLEX Mating Connector	
Housing	09-50-1031	Housing	09-50-1061
Crimp Terminal	08-70-1030	Crimp Terminal	08-70-1030

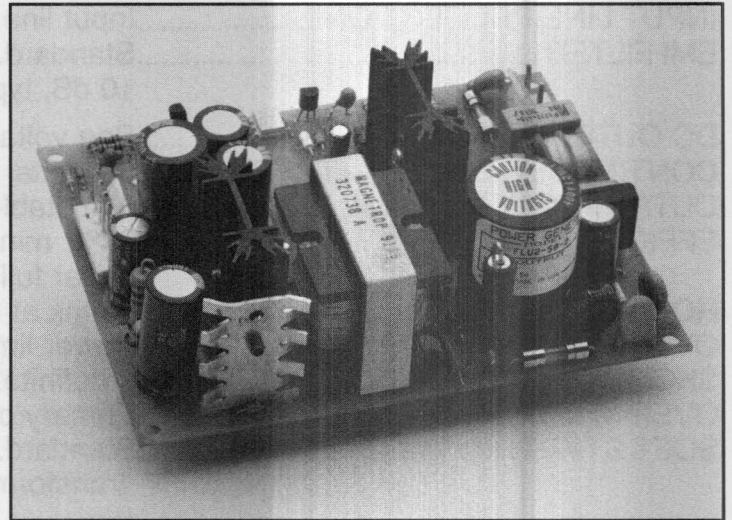
50W DUAL OUTPUT SWITCHING POWER SUPPLIES —UNIVERSAL INPUT RANGE, ULTRA-HIGH RELIABILITY—

FEATURES

- Universal Input Voltage Range
- 50 Watts Continuous Output Power
- Meets UL1950
- Meets CSA C22.2-220/C22.2-950
- Meets VDE0805
- Meets EN60950/IEC950
- VDE/FCC Class B Input Line Filter
- 0% Minimum Load Requirement
- Over-Current/Short-Circuit Protection
- 2-Year Warranty
- **Minimum 200,000 hours MTBF**

APPLICATIONS

- Data Communications Equipment
- Disk and Tape Drive Subsystems
- Portable Equipment
- CRT Terminals



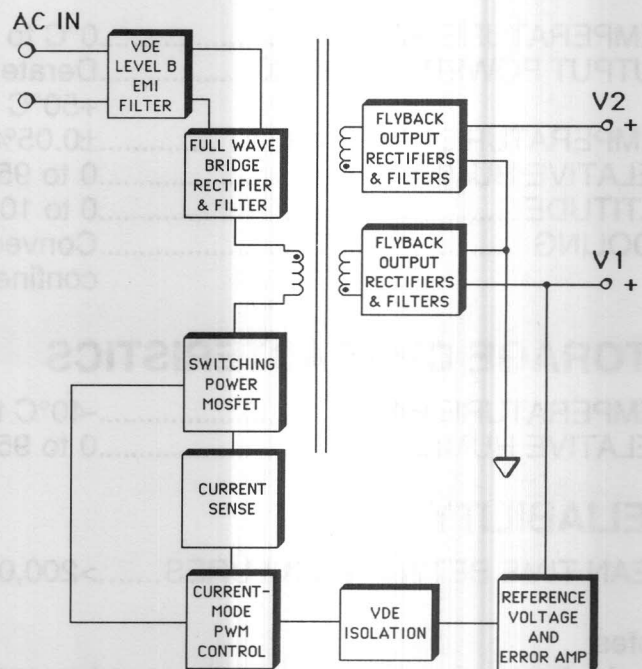
FLU2-50 is a series of dual-output, 50-watt, open-frame switching power supplies that offers high-performance features such as a universal input voltage range of 85 VAC to 265 VAC (or 100-370 VDC) and an on-board EMI filter that complies to VDE/FCC Class B specifications. The series is designed to meet international safety standards of agencies such as VDE, IEC, UL and CSA.

Two models provide outputs of 5.0V at 6A and 12V at 3A or 24V at 1.5A. Standard features include 16-millisecond hold-up time, 5300 VDC input/output isolation and an on-board input line fuse. The series provides current limiting, soft start, indefinite short-circuit protection and over-voltage protection. Efficiency is 68 percent, minimum. The primary output is adjustable ± 5 percent.

The FLU2-50 series exhibits a minimum MTBF (calculated per the "parts stress" method outlined in MIL-HDBK 217E) of 200,000 hours. Operation is specified over the 0°C to +70°C temperature range with cooling by natural convection.

Both models are fabricated on a compact 4.0 x 5.0-inch printed circuit board with a maximum component height of 1.7 inches.

FUNCTIONAL BLOCK DIAGRAM



FLU2-50 SERIES

GENERAL SPECIFICATIONS

AC INPUT	Universal input voltage range, 85-265 VAC single phase, or 100-370 VDC.
INPUT LINE FREQUENCY	47-63 Hz.
INPUT LINE PROTECTION	Input line fuse provided on-board. (See Note 1.)
EMI FILTER	Standard. Exceeds requirements of VDE/FCC Class B by 10 dB, typical.
DC OUTPUT	See voltage/current rating chart.
CONTINUOUS OUTPUT POWER	50 watts, maximum.
OUTPUT VOLTAGE ADJUST	Adjustable $\pm 5\%$, primary output only.
EFFICIENCY	68%, minimum, measured at nominal input line conditions under full load.
HOLD-UP TIME	16 ms at 115 VAC input.
OVERLOAD PROTECTION	Power-limit circuit.
SHORT-CIRCUIT PROTECTION	Indefinite.
OVER-VOLTAGE PROTECTION	Primary output only.
SOFT START	Standard. Prevents output overshoot and power transformer saturation at turn-on.
DESIGN TOPOLOGY	Flyback converter, current-mode control.
FREQUENCY OF OPERATION	33 kHz (fixed).
HI-POT ISOLATION	5300 VDC, input-to-output for one minute. (See Note 2.)
NOISE, RIPPLE and SPIKES	1% peak-to-peak, maximum. (See Note 3.)
TRANSIENT RESPONSE	4 ms recovery to within 1% of regulation band with 5% maximum deviation.

ENVIRONMENTAL OPERATING CHARACTERISTICS

TEMPERATURE RANGE	0°C to +70°C
OUTPUT POWER DERATING	Derate output power and current linearly 2%/°C from +50°C to +70°C.
TEMPERATURE COEFFICIENT	$\pm 0.05\%/^{\circ}\text{C}$ over the entire operating temperature range.
RELATIVE HUMIDITY	0 to 95%, non-condensing.
ALTITUDE	0 to 10,000 feet.
COOLING	Convection cooling is adequate. When operating in a confined area, moving air is recommended.

STORAGE CHARACTERISTICS

TEMPERATURE RANGE	-40°C to +85°C.
RELATIVE HUMIDITY	0 to 95%, non-condensing.

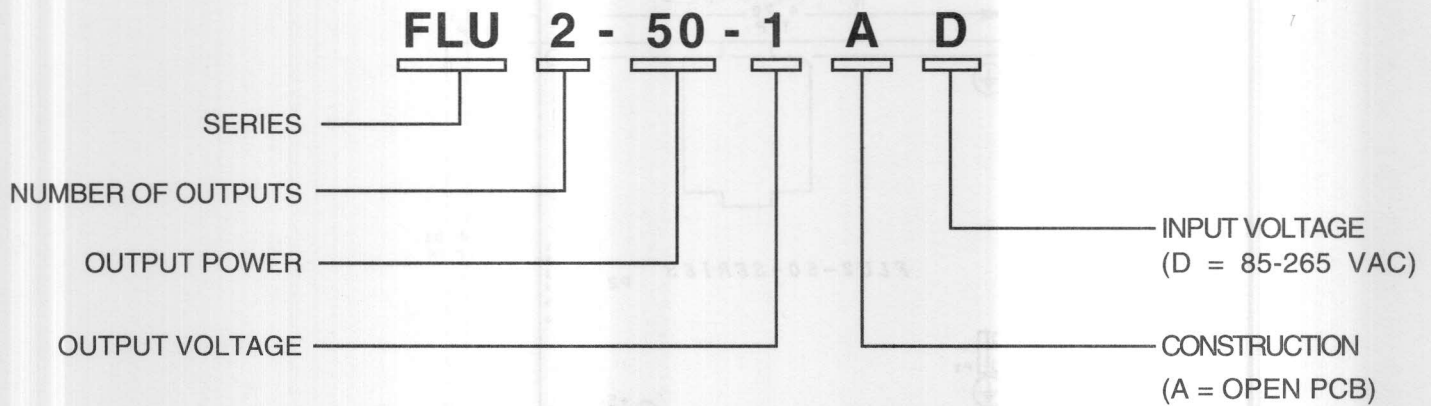
RELIABILITY

MEAN TIME BETWEEN FAILURES.....>200,000 Hours. (See Note 4.)

Notes:

1. Replace input line fuse with the same type and rating. Recommended: **2.0A/250 VAC slow-blow** fuse.
2. Hi-Pot isolation is 2200 VDC between input and ground for one minute.
3. Peak-to-peak and RMS metering equipment shall have a 20 MHz response with probes and cables maintaining a frequency response of 20 Hz to 20 MHz. Output ripple and spikes are measured directly at the output terminals of the power supply across a 0.1 μF ceramic capacitor without use of the probe ground.
4. Calculated per the "parts stress" method as outlined in MIL-HDBK 217E. Assumes ground benign and +25°C.

MODEL SELECTION GUIDE



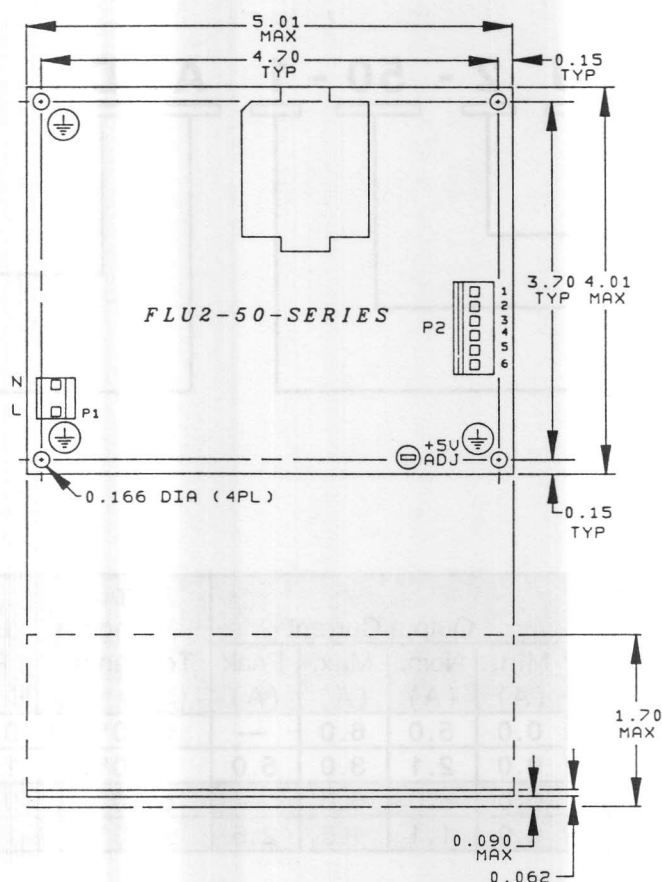
Model Number	Output Voltage		Output Current				Output Voltage Tolerance (Note 1)	Line Reg. (Note 2)	Load Reg. (Note 3)	Cross-Reg. (Note 4)
	Output	(V)	Min. (A)	Nom. (A)	Max. (A)	Peak (A)				
FLU2-50-1	V1	+5.0	0.0	5.0	6.0	—	±1.0%	0.2%	1.0%	—
	V2	+12	0.0	2.1	3.0	5.0	±5.0%	1.0%	3.0%	5.0%
FLU2-50-2	V1	+5.0	0.0	5.0	6.0	—	±1.0%	0.2%	1.0%	—
	V2	+24	0.0	1.1	1.5	2.5	±5.0%	1.0%	3.0%	5.0%

Notes:

- Output voltage tolerance is measured under nominal load conditions.
- Line regulation is measured under nominal load conditions with the input voltage varied from 85 to 265 VAC.
- Load regulation is measured at 115 VAC or 230 VAC input. The output being measured is brought to 60 percent of nominal load; that load current is then varied +40 percent/-30 percent of nominal load. The other output is held at nominal load conditions.
- Cross-regulation is tested by changing the load on the primary output from 50 percent to 100 percent of nominal load while measuring the voltage change on the auxiliary output.
- All measurements should be made directly at the terminals of the power supply.

FLU2-50 SERIES

MECHANICAL OUTLINE AND PIN CONFIGURATION



Notes:

1. Dimensions shown are in inches.
2. Tolerances = 0.00 ± 0.01
0.000 ± 0.005

PIN-OUT

Pin	FLU2-50-1	FLU2-50-2
1	+12V/3.0A	+24V/1.5A
2	+5.0V/6.0A	+5.0V/6.0A
3		
4	COMMON	COMMON
5		
6	N/C	N/C

CONNECTORS

P1 Input Connector MOLEX 26-60-4030		P2 Output Connector MOLEX 09-74-1061	
Pin 1 AC Neutral	Pin 2 AC Line		
MOLEX Mating Connector		MOLEX Mating Connector	
Housing	09-50-1031	Housing	09-50-1061
Crimp Terminal	08-70-1030	Crimp Terminal	08-70-1030

50W TRIPLE OUTPUT SWITCHING POWER SUPPLIES —UNIVERSAL INPUT RANGE, ULTRA-HIGH RELIABILITY—

FEATURES

- Universal Input Voltage Range
- 50 Watts Continuous Output Power
- UL1950 Approved
- CSA C22.2-950 Approved
- Meets VDE0805
- TUV/EN60950/IEC950 Approved
- VDE/FCC Class B Input Line Filter
- 0% Minimum Load Requirement
- Over-Current/Short-Circuit Protection
- 2-Year Warranty
- **Minimum 200,000 hours MTBF**

APPLICATIONS

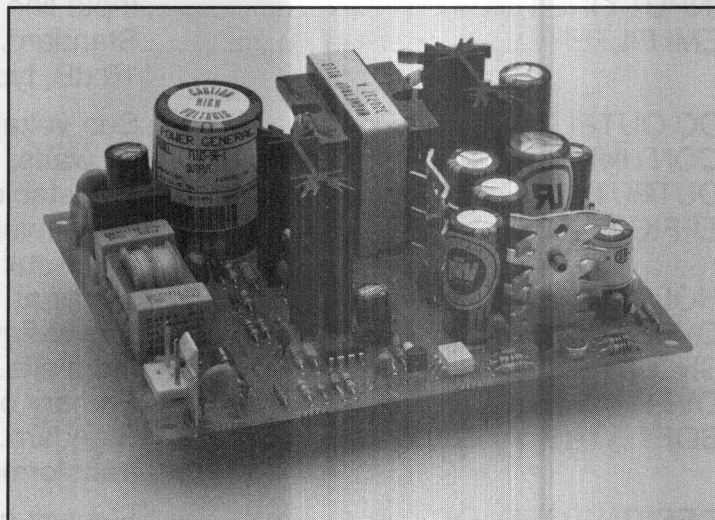
- Data Communications Equipment
- Disk and Tape Drive Subsystems
- Portable Equipment
- CRT Terminals

FLU3-50 is a series of three-output, 50-watt, open-frame switching power supplies that offers high-performance features such as a universal input voltage range of 85 VAC to 265 VAC (or 100-370 VDC) and an on-board EMI filter that complies to VDE/FCC Class B specifications. The series carries international safety agency approvals.

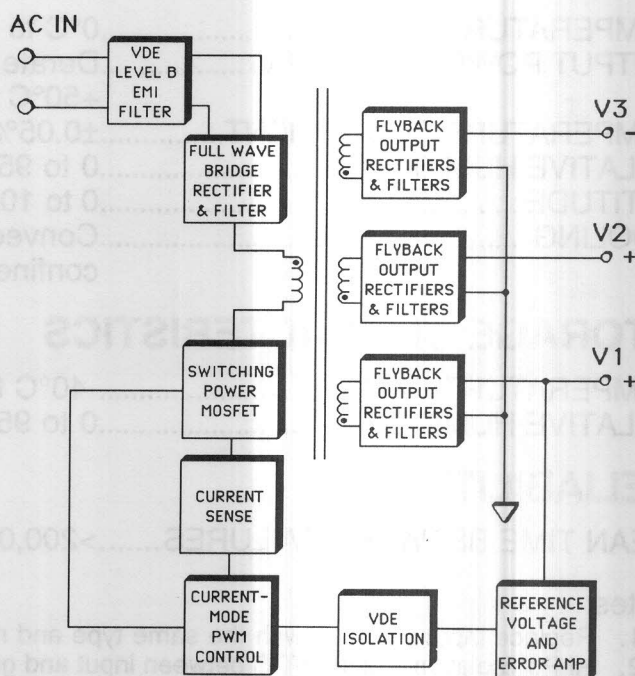
Three models provide output combinations of +5.0V and $\pm 12V$, +5.0V and $\pm 15V$, or +5.0V, +12V and -5.0V. Standard features include 16-millisecond hold-up time, 5300 VDC input/output isolation and an on-board input line fuse. The series provides current limiting, soft start, indefinite short-circuit protection and over-voltage protection. Efficiency is 65 percent, minimum. The primary output is adjustable ± 5 percent.

The FLU3-50 series exhibits a minimum MTBF (calculated per the "parts stress" method outlined in MIL-HDBK 217E) of 200,000 hours. Operation is specified over the 0°C to +70°C temperature range with cooling by natural convection.

All models are fabricated on a compact 4.0 x 5.0-inch printed circuit board with a maximum component height of 1.7 inches.



FUNCTIONAL BLOCK DIAGRAM



FLU3-50 SERIES

GENERAL SPECIFICATIONS

AC INPUT	Universal input voltage range, 85-265 VAC single phase, or 100-370 VDC.
INPUT LINE FREQUENCY	47-63 Hz.
INPUT LINE PROTECTION	Input line fuse provided on-board. (See Note 1.)
EMI FILTER	Standard. Exceeds requirements of VDE/FCC Class B by 10 dB, typical.
DC OUTPUT	See voltage/current rating chart.
CONTINUOUS OUTPUT POWER	50 watts, maximum.
OUTPUT VOLTAGE ADJUST	Adjustable $\pm 5\%$, primary output only.
EFFICIENCY	68%, minimum, measured at nominal input line conditions under full load.
HOLD-UP TIME	16 ms at 115 VAC input.
OVERLOAD PROTECTION	Power-limit circuit.
SHORT-CIRCUIT PROTECTION	Indefinite.
OVER-VOLTAGE PROTECTION	Primary output only.
SOFT START	Standard. Prevents output overshoot and power transformer saturation at turn-on.
DESIGN TOPOLOGY	Flyback converter, current-mode control.
FREQUENCY OF OPERATION	33 kHz (fixed).
HI-POT ISOLATION	5300 VDC, input-to-output for one minute. (See Note 2.)
NOISE, RIPPLE and SPIKES	1% peak-to-peak, maximum. (See Note 3.)
TRANSIENT RESPONSE	4 ms recovery to within 1% of regulation band with 5% maximum deviation.

ENVIRONMENTAL OPERATING CHARACTERISTICS

TEMPERATURE RANGE	0°C to +70°C
OUTPUT POWER DERATING	Derate output power and current linearly 2%/°C from +50°C to +70°C.
TEMPERATURE COEFFICIENT	$\pm 0.05\%/^{\circ}\text{C}$ over the entire operating temperature range.
RELATIVE HUMIDITY	0 to 95%, non-condensing.
ALTITUDE	0 to 10,000 feet.
COOLING	Convection cooling is adequate. When operating in a confined area, moving air is recommended.

STORAGE CHARACTERISTICS

TEMPERATURE RANGE	-40°C to +85°C.
RELATIVE HUMIDITY	0 to 95%, non-condensing.

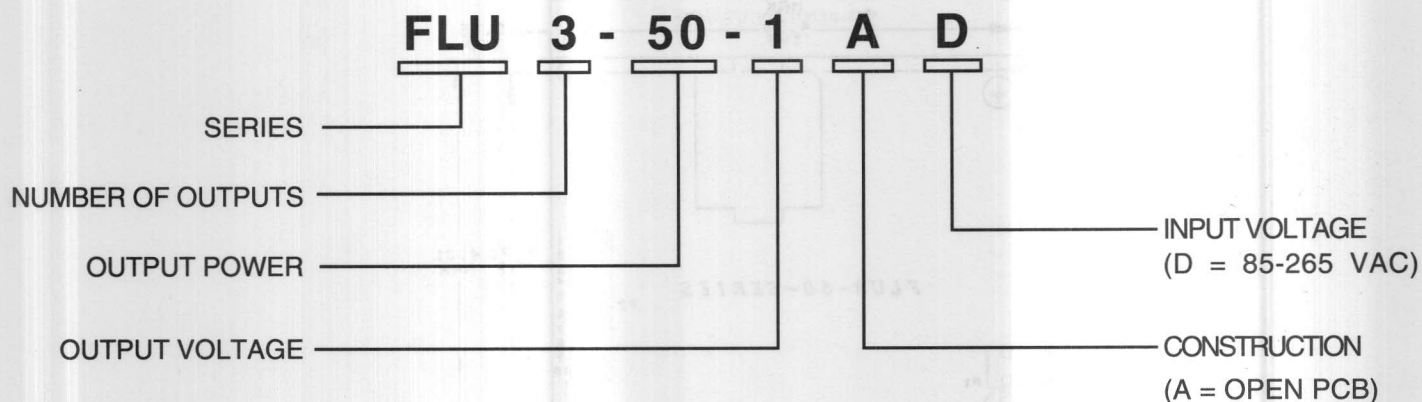
RELIABILITY

MEAN TIME BETWEEN FAILURES.....>200,000 hours. (See Note 4.)

Notes:

1. Replace input line fuse with the same type and rating. Recommended: **2.0A/250 VAC slow-blow** fuse.
2. Hi-Pot isolation is 2200 VDC between input and ground for one minute.
3. Peak-to-peak and RMS metering equipment shall have a 20 MHz response with probes and cables maintaining a frequency response of 20 Hz to 20 MHz. Output ripple and spikes are measured directly at the output terminals of the power supply across a 0.1 μF ceramic capacitor without use of the probe ground.
4. Calculated per the "parts stress" method as outlined in MIL-HDBK 217E. Assumes ground benign and +25°C.

MODEL SELECTION GUIDE



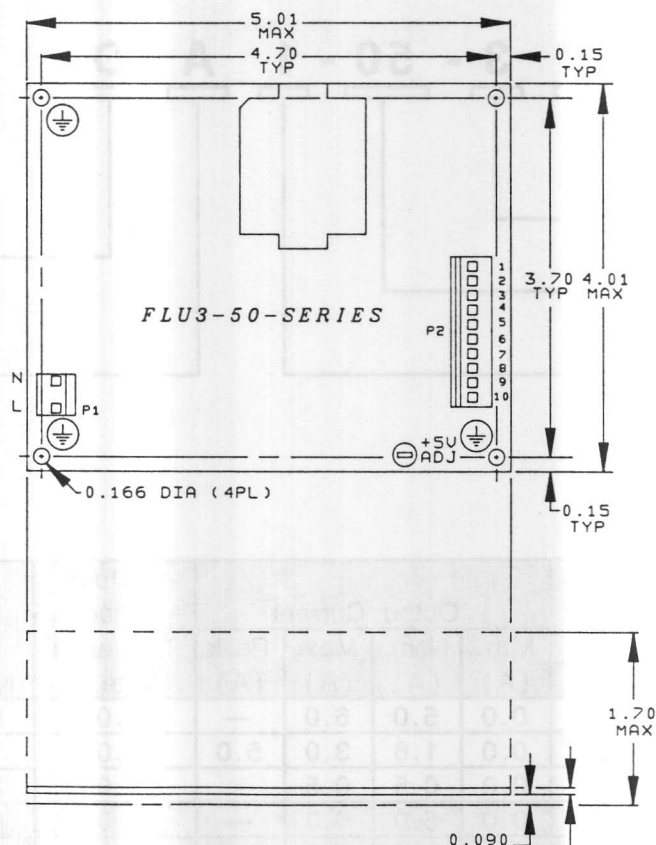
Model Number	Output Voltage		Output Current				Output Voltage Tolerance (Note 1)	Line Reg. (Note 2)	Load Reg. (Note 3)	Cross-Reg. (Note 4)
			Min. (A)	Nom. (A)	Max. (A)	Peak (A)				
	Output	(V)								
FLU3-50-1	V1	+5.0	0.0	5.0	6.0	—	±1.0%	0.2%	1.0%	—
	V2	+12	0.0	1.6	3.0	5.0	±5.0%	1.0%	2.0%	5.0%
	V3	-12	0.0	0.5	0.5	—	±5.0%	2.0%	3.0%	5.0%
FLU3-50-2	V1	+5.0	0.0	5.0	6.0	—	±1.0%	0.2%	1.0%	—
	V2	+12	0.0	1.8	3.0	5.0	±5.0%	1.0%	3.0%	5.0%
	V3	-5.0	0.0	0.5	0.5	—	±3.0%	0.5%	1.0%	1.0%
FLU3-50-3	V1	+5.0	0.0	5.0	6.0	—	±1.0%	0.2%	1.0%	—
	V2	+15	0.0	1.15	2.0	5.0	±5.0%	1.0%	3.0%	5.0%
	V3	-15	0.0	0.5	0.5	—	±3.0%	0.5%	1.0%	1.0%
FLU3-50-4	V1	5.0 (ISO)	0.0	8.0	9.0	—	±1.0%	0.2%	0.5%	—
	V2	12 (ISO)	0.0	0.4	0.6	—	±3.0%	0.5%	1.0%	1.0%
	V3	12 (ISO)	0.0	0.4	0.6	—	±3.0%	0.5%	1.0%	1.0%
FLU3-50-5	V1	5.0 (ISO)	0.0	8.0	9.0	—	±1.0%	0.2%	0.5%	—
	V2	15 (ISO)	0.0	0.35	0.6	—	±3.0%	0.5%	1.0%	1.0%
	V3	15 (ISO)	0.0	0.35	0.6	—	±3.0%	0.5%	1.0%	1.0%

Notes:

- Output voltage tolerance is measured under nominal load conditions.
- Line regulation is measured under nominal load conditions with the input voltage varied from 85 to 265 VAC.
- Load regulation is measured at 115 VAC or 230 VAC input. The output being measured is brought to 60 percent of nominal load; that load current is then varied +40 percent/-30 percent of nominal load. The other output is held at nominal load conditions.
- Cross-regulation is tested by changing the load on the primary output from 50 percent to 100 percent of nominal load while measuring the voltage change on the auxiliary output.
- All measurements should be made directly at the terminals of the power supply.
- The FLU3-50 series is approved to UL1950 (File No. E76127), CSA C22.2-950 (File No. LR52335) and EN60950/IEC950 (TUV License R9171470).

FLU3-50 SERIES

MECHANICAL OUTLINE AND PIN CONFIGURATION



Notes:

1. Dimensions shown are in inches.
2. Tolerances = 0.00 ±0.01
0.000 ±0.005

PIN-OUT

Pin	FLU3-50-1	FLU3-50-2	FLU3-50-3	FLU3-50-4	FLU3-50-5
1	+12V/3.0A	+12V/3.0A	+15V/2.0A	+V2	+V2
2	+5.0V	+5.0V	+5.0V	-V2	-V2
3	6.0A	6.0A	6.0A		
4	COMMON	COMMON	COMMON	+V1	+V1
5					
6	-12V/0.5A	-5.0V/0.5A	-15V/0.5A		
7	N/A	N/A	N/A	-V1	-V1
8	N/A	N/A	N/A		
9	N/A	N/A	N/A	-V3	-V3
10	N/A	N/A	N/A	+V3	+V3

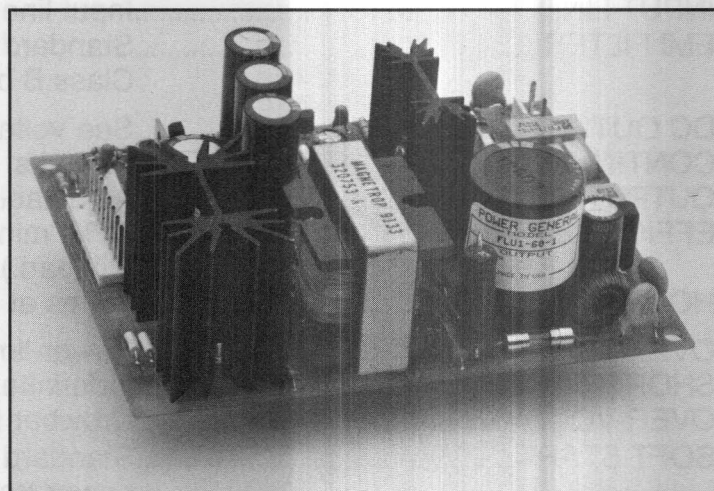
CONNECTORS

<u>P1 Input Connector</u> MOLEX 26-60-4030		<u>P2 Output Connector</u> Models 1 through 3: MOLEX 09-74-1061	<u>P2 Output Connector</u> Models 4 and 5: MOLEX 09-74-1101
<u>Pin 1</u> AC Neutral	<u>Pin 2</u> AC Line		
MOLEX Mating Connector		MOLEX Mating Connector	MOLEX Mating Connector
Housing	09-50-1031	Housing	09-50-1061
Crimp Terminal	08-70-1030	Crimp Terminal	08-70-1030
			Housing 09-50-1101
			Crimp Terminal 08-70-1030

60W SINGLE OUTPUT SWITCHING POWER SUPPLIES —UNIVERSAL INPUT, ULTRA-HIGH RELIABILITY—

FEATURES

- 85-265 VAC Input Voltage Range
- 60 Watts Continuous Output Power
- Meets UL1950
- Meets CSA C22.2-220/C22.2-950
- Meets VDE0805
- Meets TUV/EN60950/IEC950
- VDE/FCC Class B Input Line Filter
- 0% Minimum Load Requirement
- Indefinite Short-Circuit Protection
- 2-Year Warranty
- **Minimum 200,000 Hours MTBF**



APPLICATIONS

- Data Communications Equipment
- Disk and Tape Drive Subsystems
- Microcomputer Systems
- Industrial Test and Control Equipment

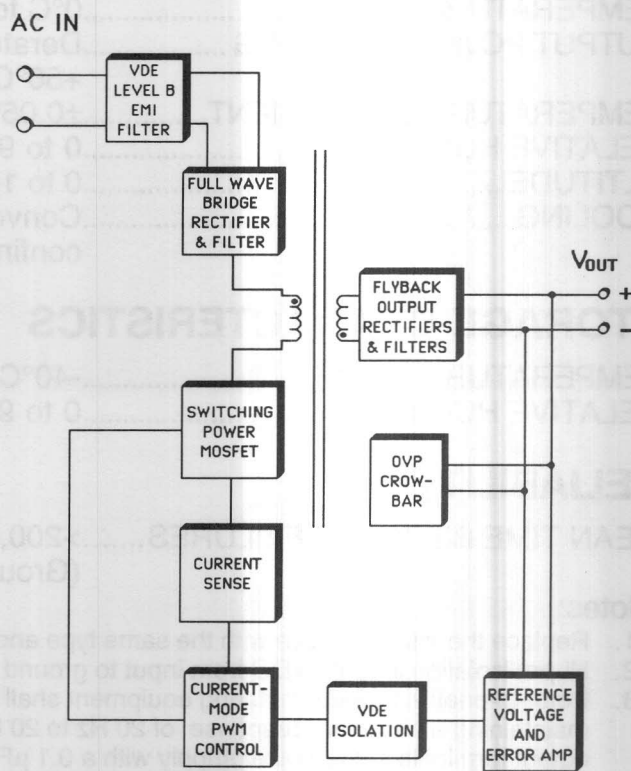
FLU1-60 is a series of single output, 60-watt, open-frame switching power supplies designed to meet international safety agency standards, including those of VDE, IEC, UL and CSA. The supplies offer high-performance features such as a universal input range of 85 VAC to 265 VAC (or 100-370 VDC) and an on-board EMI suppression filter that complies to VDE/FCC Class B specifications.

Six models provide tightly regulated outputs of 5.0, 9.0, 12, 15, 24 or 28 VDC. Standard features include 16-millisecond hold-up time, 5300 VDC input/output isolation and an on-board input line fuse. The series provides soft start, indefinite short-circuit protection, over-voltage protection and current limiting. Efficiency is 67 percent; minimum; load regulation is ± 0.2 percent; the output is adjustable ± 5 percent.

The Power General FLU1-60 series is designed for ultra-high reliability. The minimum MTBF (calculated using the "parts stress" method of MIL-HDBK 217E) is 200,000 hours. Operation is specified over the temperature range of 0°C to +70°C with cooling by natural convection.

All models are fabricated on a compact 4.0 x 5.0-inch printed circuit board with a maximum component height of 1.7 inches.

FUNCTIONAL BLOCK DIAGRAM



FLU1-60 SERIES

GENERAL SPECIFICATIONS

AC INPUT	Universal input voltage range 85-265 VAC single phase or 100-370 VDC.
INPUT LINE FREQUENCY	47-63 Hz.
INPUT LINE PROTECTION	Input line fuse on-board. (See Note 1.)
EMI FILTER	Standard. Exceeds minimum requirements of VDE/FCC Class B by 10 dB, typical.
DC OUTPUT	See voltage/current rating chart.
CONTINUOUS OUTPUT POWER	60 watts, maximum.
OUTPUT VOLTAGE ADJUST	Adjustable $\pm 5\%$.
EFFICIENCY	67%, minimum. (Nominal input voltage line conditions and full load.)
HOLD-UP TIME	16 ms at 115 VAC, full load conditions.
OVERLOAD PROTECTION	Power-limit circuit.
SHORT-CIRCUIT PROTECTION	Indefinite.
OVER-VOLTAGE PROTECTION	Crowbar type (120% of V_{OUT} , typical).
SOFT START	Standard on all models. Prevents output overshoot and power transformer saturation at turn-on.
DESIGN TOPOLOGY	Flyback converter, current-mode control.
FREQUENCY OF OPERATION	33 kHz (fixed).
HI-POT ISOLATION	5300 VDC, input-to-output for one minute. (See Note 2.)
NOISE, RIPPLE & SPIKES	1% peak-to-peak, maximum. (See Note 3.)

ENVIRONMENTAL OPERATING CHARACTERISTICS

TEMPERATURE RANGE	0°C to +70°C.
OUTPUT POWER DERATING	Derate output power and current linearly 2%/°C from +50°C to +70°C.
TEMPERATURE COEFFICIENT	$\pm 0.05\%/^{\circ}\text{C}$ over the entire operating temperature range.
RELATIVE HUMIDITY	0 to 95%, non-condensing.
ALTITUDE	0 to 10,000 feet.
COOLING	Convection cooling is adequate. When operating in a confined area, moving air is recommended.

STORAGE CHARACTERISTICS

TEMPERATURE RANGE	-40°C to +85°C.
RELATIVE HUMIDITY	0 to 95%, non-condensing.

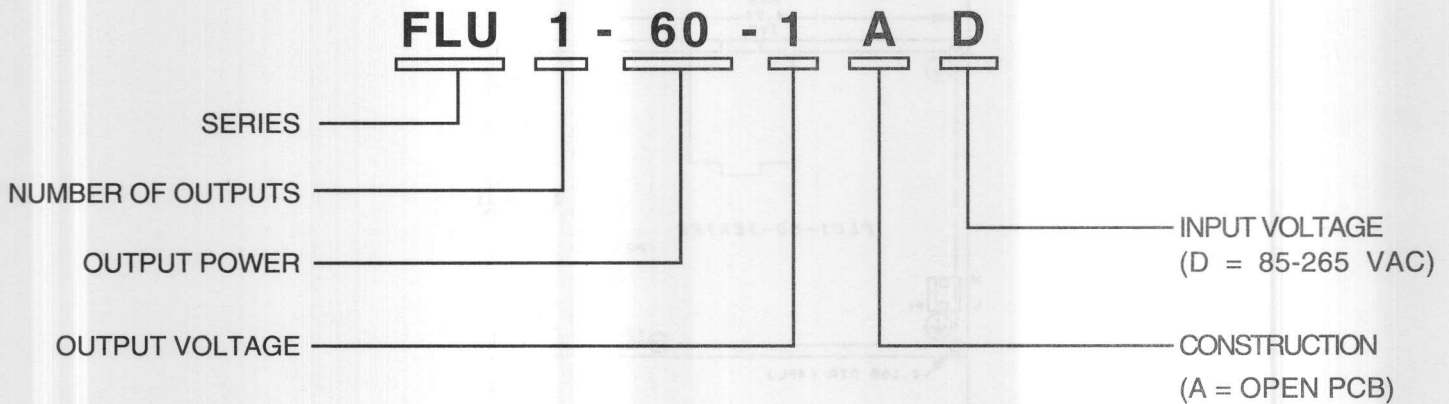
RELIABILITY

MEAN TIME BETWEEN FAILURES	>200,000 hours, per MIL-HDBK 217E Parts Stress Method. (Ground benign, +25°C.)
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Notes:

1. Replace the input line fuse with the same type and rating. Recommended: **2.0A/250 VAC slow-blow fuse.**
2. Hi-pot isolation is 2200 VDC from input to ground for 60 seconds.
3. Peak-to-peak and RMS metering equipment shall have a 20 MHz frequency response with probes and cables maintaining a frequency response of 20 Hz to 20 MHz. Output ripple and spikes are measured directly at the output terminals of the power supply with a 0.1 μF ceramic capacitor without the use of the probe ground clip.

MODEL SELECTION GUIDE



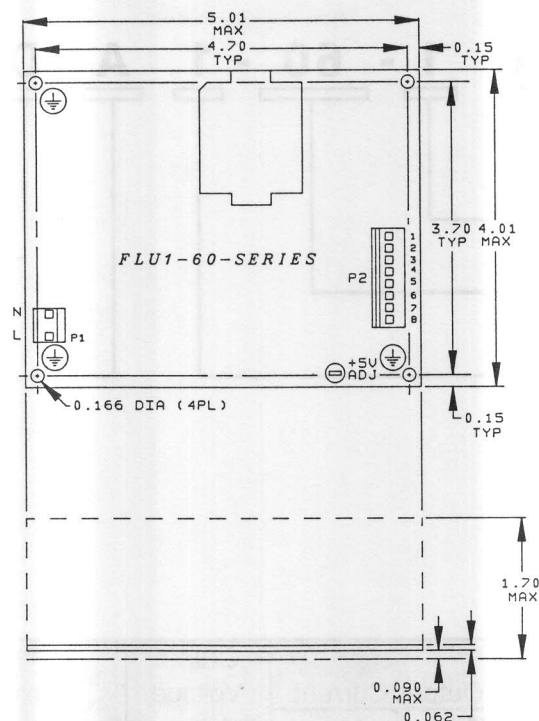
Model Number	Output Voltage (V)	Output Current		Output Voltage Tolerance (Note 1)	Line Reg. (Note 2)	Load Reg. (Note 3)	Efficiency (Note 4)
		Min. (A)	Max. (A)				
FLU1-60-1	+5.0	0.0	12	±1%	0.1%	0.2%	67%
FLU1-60-2	+9.0	0.0	6.7	±1%	0.1%	0.2%	69%
FLU1-60-3	+12	0.0	5.0	±1%	0.1%	0.2%	71%
FLU1-60-4	+15	0.0	4.0	±1%	0.1%	0.2%	74%
FLU1-60-5	+24	0.0	2.5	±1%	0.1%	0.2%	75%
FLU1-60-6	+28	0.0	2.15	±1%	0.1%	0.2%	76%

Notes:

1. Output voltage tolerance is measured at full load conditions.
2. Line regulation is measured under full load conditions with the input voltage varied from 85 VAC to 265 VAC.
3. Load regulation is measured by varying the load from 0 to 100 percent of rated load.
4. Efficiency is measured under full load conditions.
5. All measurements should be made directly at the terminals of the power supply.

FLU1-60 SERIES

MECHANICAL OUTLINE AND PIN CONFIGURATION



- Notes:
- 1. Dimensions shown are in inches.
 - 2. Tolerances = 0.00 ±0.01 inch.
0.000 ±0.005 inch
 - 3. If sense terminals are *not* used, tie Pins 1 and 2 together and tie Pins 7 and 8 together.
 - 4. For proper grounding, all ground pins should be tied to chassis ground.

PIN-OUT

Pin	FLU1-60-1	FLU1-60-2	FLU1-60-3	FLU1-60-4	FLU1-60-5	FLU1-60-6
1	+ SENSE (See Note 3)	+ SENSE (See Note 3)	+ SENSE (See Note 3)	+ SENSE (See Note 3)	+ SENSE (See Note 3)	+ SENSE (See Note 3)
2	+5.0V/12A	+9.0V/6.7A	+12V/5.0A	+15V/4.0A	+24V/2.5A	+28V/2.15A
3						
4						
5	COMMON	COMMON	COMMON	COMMON	COMMON	COMMON
6						
7						
8	- SENSE	- SENSE	- SENSE	- SENSE	- SENSE	- SENSE

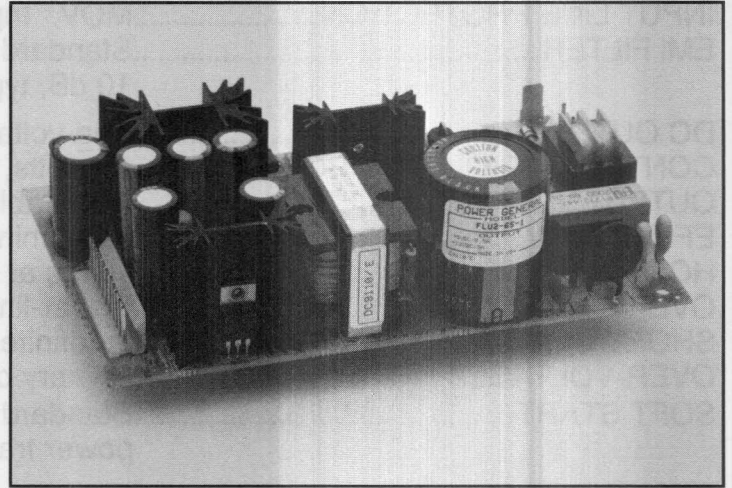
CONNECTORS

<u>P1 Input Connector</u> MOLEX 09-74-1031		<u>P2 Output Connector</u> MOLEX 09-74-1081	
Pin 1	Pin 2	MOLEX Mating Connector Housing 09-50-1081 Crimp Terminal 08-70-1030	
AC Neutral	AC Line		
MOLEX Mating Connector Housing 09-50-1031 Crimp Terminal 08-70-1030			

65W DUAL OUTPUT SWITCHING POWER SUPPLIES —UNIVERSAL INPUT RANGE, ULTRA-HIGH RELIABILITY—

FEATURES

- 85-265 VAC Input Voltage Range
- 65 Watts Continuous Output Power
- UL1950 Approved
- CSA C22.2-950 Approved
- Meets VDE0805
- TUV/EN60950/IEC950 Approved
- VDE/FCC Class B Input Line Filter
- 0% Minimum Load on Both Outputs
- Over-Current/Short-Circuit Protection
- 2-Year Warranty
- **Minimum 185,000 hours MTBF**



APPLICATIONS

- Data Communications Equipment
- Microcomputer-Based Systems
- Industrial Equipment and Instrumentation

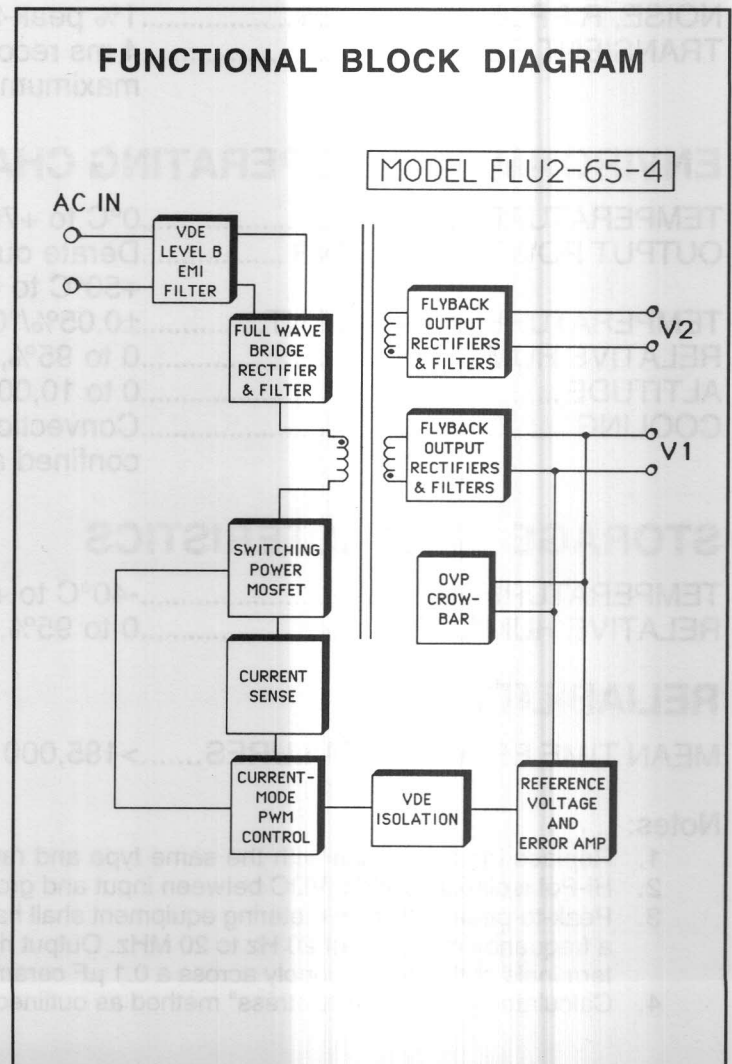
FLU2-65 is a series of two-output, 65-watt, open-frame switching power supplies. Approved to international safety agency standards, these supplies offer high-performance features such as a universal input voltage range of 85 VAC to 265 VAC (or 100-370 VDC) and an on-board EMI filter that complies to VDE/FCC Class B specifications.

Five models provide dc output combinations of +5.0V and +12V, +24V, isolated 5.0V or isolated 12V. Standard features include 16-millisecond hold-up time, 5300 VDC input/output isolation and an on-board input line fuse. Other features include soft start, current limiting, indefinite short-circuit protection and over-voltage protection. Efficiency is 65%, minimum, primary load regulation is 1.0 percent; the primary output is adjustable $\pm 5\%$.

The FLU2-65 series is designed to achieve ultra-high reliability. The minimum MTBF (calculated per the "parts stress" method outlined in MIL-HDBK 217E) is greater than 185,000 hours. Operation is specified over the 0°C to +70°C temperature range with cooling by natural convection.

All models are fabricated on double-sided printed circuit boards: 4.0 x 7.25 inches with a maximum component height of 2.0 inches, or 4.0 x 6.5 inches with a maximum component height of 1.85 inches.

FUNCTIONAL BLOCK DIAGRAM



FLU2-65 SERIES

GENERAL SPECIFICATIONS

AC INPUT	Universal input voltage range 85-265 VAC single phase or 100-370 VDC.
INPUT LINE FREQUENCY	47-63 Hz.
INPUT LINE PROTECTION	MOV. Input line fuse provided on-board. (See Note 1.)
EMI FILTER	Standard. Exceeds requirements of VDE/FCC Class B by 10 dB, typical.
DC OUTPUT	See voltage/current rating chart.
CONTINUOUS OUTPUT POWER	65 watts, maximum.
OUTPUT VOLTAGE ADJUST	Adjustable $\pm 5\%$, primary output only.
EFFICIENCY	65%, minimum. Measured at full load, nominal input line.
HOLD-UP TIME	16 ms at 115 VAC, typical.
OVERLOAD PROTECTION	Power-limit circuit.
SHORT-CIRCUIT PROTECTION	Indefinite.
OVER-VOLTAGE PROTECTION	Primary output only, crowbar type (120% of V_{OUT} , typical).
SOFT START	Standard on all models. Prevents output overshoot and power transformer saturation at turn-on.
DESIGN TOPOLOGY	Flyback converter, current-mode control.
FREQUENCY OF OPERATION	40 kHz (fixed).
HI-POT ISOLATION	5300 VDC, input-to-output for one minute. (See Note 2.)
NOISE, RIPPLE and SPIKES	1% peak-to-peak, maximum. (See Note 3.)
TRANSIENT RESPONSE	4 ms recovery to within 1% of regulation band with 5% maximum deviation.

ENVIRONMENTAL OPERATING CHARACTERISTICS

TEMPERATURE RANGE	0°C to +70°C
OUTPUT POWER DERATING	Derate output power and current linearly 2%/°C from +50°C to +70°C.
TEMPERATURE COEFFICIENT	$\pm 0.05\%/^{\circ}\text{C}$ over the entire operating temperature range.
RELATIVE HUMIDITY	0 to 95%, non-condensing.
ALTITUDE	0 to 10,000 feet.
COOLING	Convection cooling is adequate. When operating in a confined area, moving air is recommended.

STORAGE CHARACTERISTICS

TEMPERATURE RANGE	-40°C to +85°C.
RELATIVE HUMIDITY	0 to 95%, non-condensing.

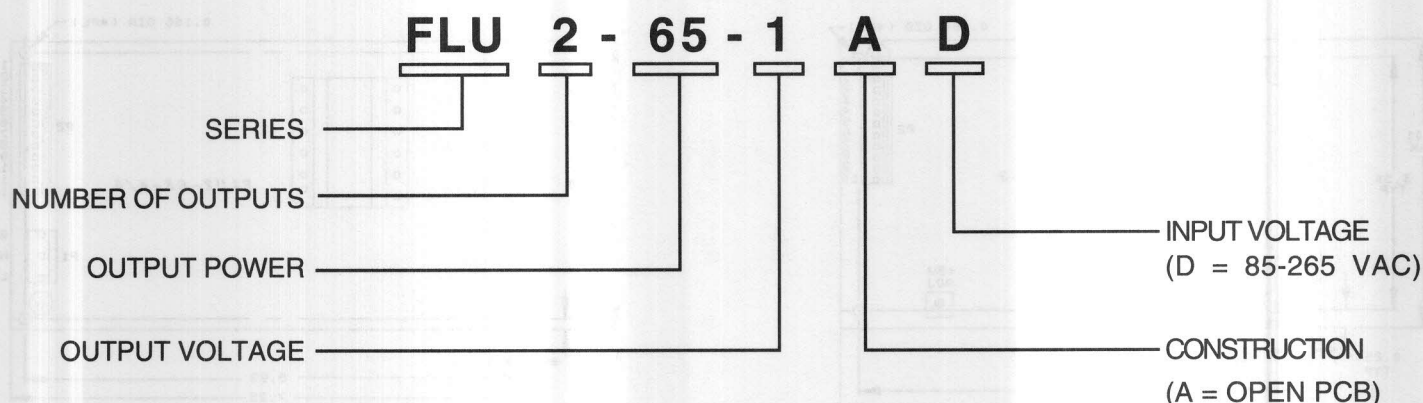
RELIABILITY

MEAN TIME BETWEEN FAILURES.....>185,000 hours. (See Note 4.)

Notes:

1. Replace input line fuse with the same type and rating. Recommended: **2.0A/250 VAC slow-blow** fuse.
2. Hi-Pot isolation is 2200 VDC between input and ground for one minute.
3. Peak-to-peak and RMS metering equipment shall have a 20 MHz response with probes and cables maintaining a frequency response of 20 Hz to 20 MHz. Output ripple and spikes are measured directly at the output terminals of the power supply across a 0.1 μF ceramic capacitor without use of the probe ground.
4. Calculated per the "parts stress" method as outlined in MIL-HDBK 217E. Assumes ground benign and +25°C.

MODEL SELECTION GUIDE



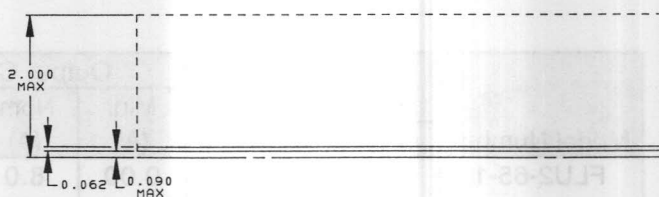
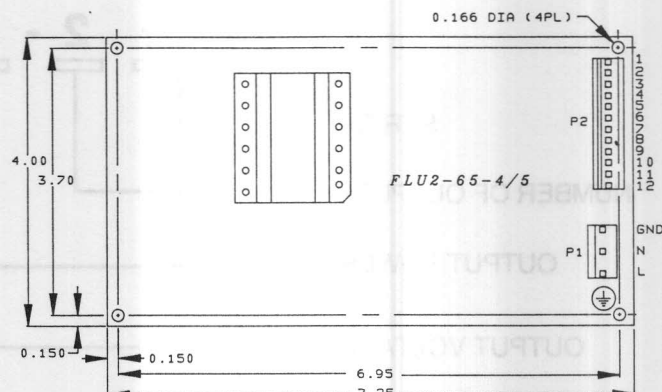
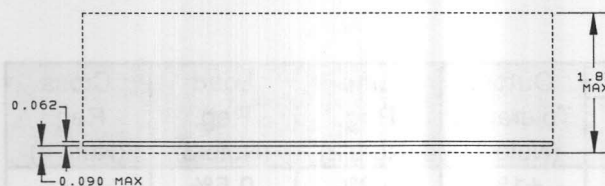
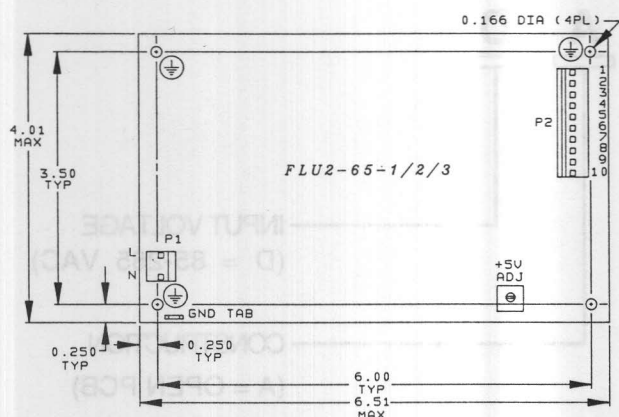
Model Number	Output Voltage		Output Current			Output Tolerance (Note 1)	Line Reg. (Note 2)	Load Reg. (Note 3)	Cross Reg. (Note 4)
	Output	(V)	Min.	Nom.	Max.				
			(A)	(A)	(A)				
FLU2-65-1	V1	+5.0	0.00	8.0	8.5	±1%	0.2%	0.5%	—
	V2	+12	0.00	2.5	3.0	±5%	0.5%	5.0%	4.0%
FLU2-65-2	V1	+5.0	0.00	4.0	5.0	±1%	0.2%	0.5%	—
	V2	+12	0.00	4.0	5.0	±5%	0.5%	5.0%	4.0%
FLU2-65-3	V1	+5.0	0.00	8.0	8.5	±1%	0.2%	0.5%	—
	V2	+24	0.00	1.25	2.5	±5%	0.5%	5.0%	4.0%
FLU2-65-4	V1	5.0 (ISO)	0.00	11	11	±1%	0.2%	0.5%	—
	V2	5.0 (ISO)	0.00	2.0	2.0	±3%	0.5%	1.0%	1.0%
FLU2-65-5	V1	5.0 (ISO)	0.00	8.0	11	±1%	0.2%	0.5%	—
	V2	12 (ISO)	0.00	2.0	2.0	±3%	0.5%	1.0%	1.0%

Notes:

- Output tolerance is measured under nominal load conditions.
- Line regulation is measured under nominal load conditions with the input voltage varied from 85 to 265 VAC.
- Load regulation is measured at 115 VAC or 230 VAC input; the output being measured is loaded to 60% of nominal; that load is then varied +40%/-30%. The other output is nominally loaded.
- Cross-regulation is tested by changing the load on the primary output (V1) from 50% to 100% of nominal load while measuring the voltage change on the auxiliary output.
- All measurements should be made directly at the terminals of the power supply.
- The FLU2-65 series is approved to UL1950 (File E76127 and E140439), CSA C22.2-950 (File LR52335) and EN60950/IEC950 (TUV License R7629).

FLU2-65 SERIES

MECHANICAL OUTLINE AND PIN CONFIGURATION



Notes:

1. Dimensions shown are in inches.
2. Tolerances = 0.00 ±0.01
0.000 ±0.005

PIN-OUT

Pin	FLU2-65-1	FLU2-65-2	FLU2-65-3	FLU2-65-4	FLU2-65-5
1	COMMON	COMMON	COMMON	+ V1	+ V1
2	COMMON	COMMON	COMMON		
3	V2	V2	V2		
4	V2	V2	V2	- V1	- V1
5	COMMON	COMMON	COMMON		
6	COMMON	COMMON	COMMON		
7	COMMON	COMMON	COMMON	N/C	N/C
8	V1	V1	V1		
9	V1	V1	V1		
10	V1	V1	V1	- V2	- V2
11	NO PIN	NO PIN	NO PIN		
12	NO PIN	NO PIN	NO PIN		
				+ V2	+ V2

CONNECTORS

P1 Input Connector		P1 Input Connector		P2 Output Connector		P2 Output Connector	
Models 1 through 3		Models 4 and 5		Models 1 through 3		Models 4 and 5	
MOLEX 09-74-1031		MOLEX 09-74-1051		MOLEX 09-74-1101		MOLEX 09-74-1121	
Pin	Function	Pin	Function				
1	AC Line	1	AC Line				
2	AC Neutral	2	AC Neutral				
		3	Ground				
MOLEX Mating Connector		MOLEX Mating Connector		MOLEX Mating Connector		MOLEX Mating Connector	
Housing	09-50-1031	Housing	09-50-1051	Housing	09-50-1101	Housing	09-50-1121
Crimp Terminal	08-70-1030	Crimp Terminal	08-70-1030	Crimp Terminal	08-70-1030	Crimp Terminal	08-70-1030

65W TRIPLE OUTPUT SWITCHING POWER SUPPLIES —UNIVERSAL INPUT RANGE, ULTRA-HIGH RELIABILITY—

FEATURES

- 85-265 VAC Input Voltage Range
- 65 Watts Continuous Output Power
- UL1950 Approved
- CSA C22.2-220/C22.2-950 Approved
- Meets VDE0805
- TUV/EN60950/IEC950 Approved
- VDE/FCC Class B Input Line Filter
- 0% Minimum Load on All Outputs
- Over-Current/Short-Circuit Protection
- 2-Year Warranty
- **Minimum 175,000 Hours MTBF**

APPLICATIONS

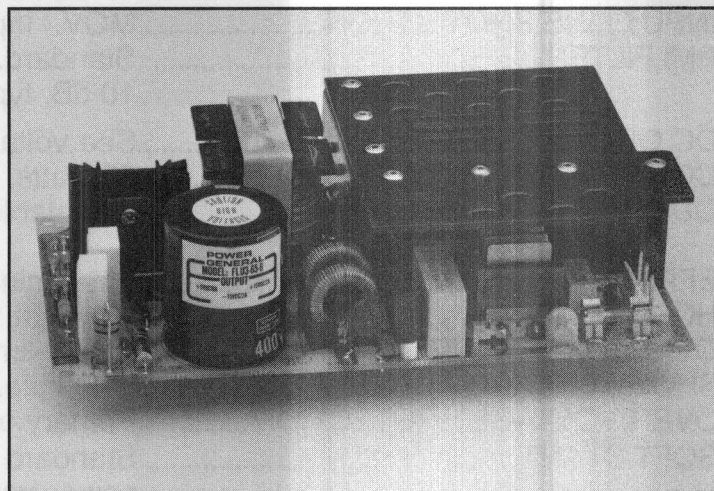
- Data Communications Equipment
- Microcomputer-Based Systems
- Industrial Equipment and Instrumentation

FLU3-65 is a series of three-output, 65-watt, open-frame switching power supplies. Approved to international safety agency standards, these supplies offer high-performance features such as a universal input voltage range of 85 VAC to 265 VAC (or 100-370 VDC) and an on-board EMI filter that complies to VDE/FCC Class B specifications.

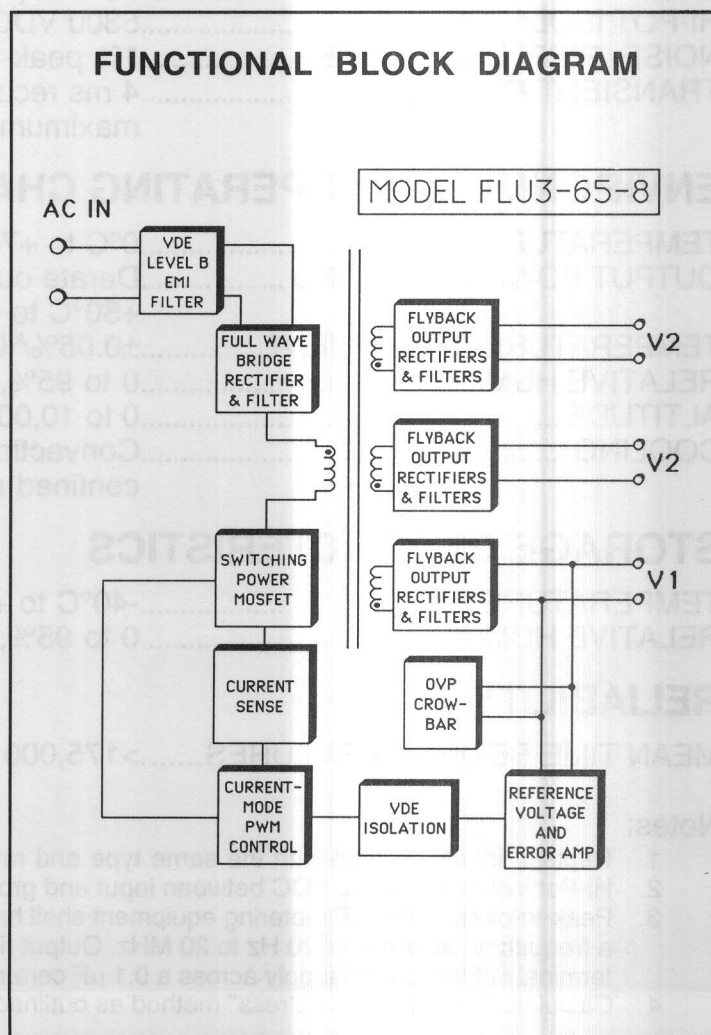
Ten models provide dc output of 5.0V and combinations of -5.0V, $\pm 12V$, $\pm 15V$, and $\pm 24V$. Six models offer fully isolated outputs. Standard features include 16-millisecond hold-up time, 5300 VDC input/output isolation and an on-board input line fuse. Other features include soft start, current limiting, indefinite short-circuit protection and over-voltage protection. Efficiency is 65%, minimum; primary load regulation is 0.5 percent or better; the primary output is adjustable $\pm 5\%$.

The FLU3-65 series is designed to achieve ultra-high reliability. The minimum MTBF (calculated per the "parts stress" method outlined in MIL-HDBK 217E) is greater than 175,000 hours. Operation is specified over the 0°C to $+70^{\circ}\text{C}$ temperature range with cooling by natural convection.

All models are fabricated on a compact, double-sided 4.0 x 7.25-inch printed circuit board with a maximum component height of 2.0 inches.



FUNCTIONAL BLOCK DIAGRAM



FLU3-65 SERIES

GENERAL SPECIFICATIONS

AC INPUT	Universal input voltage range 85-265 VAC single phase or 100-370 VDC.
INPUT LINE FREQUENCY.....	47-63 Hz.
INPUT LINE PROTECTION.....	MOV. Input line fuse provided on-board. (See Note 1.)
EMI FILTER	Standard. Exceeds requirements of VDE/FCC Class B by 10 dB, typical.
DC OUTPUT	See voltage/current rating chart.
CONTINUOUS OUTPUT POWER	65 watts, maximum.
OUTPUT VOLTAGE ADJUST.....	Adjustable $\pm 5\%$, primary output only.
EFFICIENCY	65%, minimum. Measured at full load and nominal input.
HOLD-UP TIME	16 ms at 115 VAC, typical.
OVERLOAD PROTECTION.....	Power-limit circuit.
SHORT-CIRCUIT PROTECTION.....	Indefinite.
OVER-VOLTAGE PROTECTION.....	Primary output only, crowbar type (120% of V_{OUT} , typical).
SOFT START	Standard on all models. Prevents output overshoot and power transformer saturation at turn-on.
DESIGN TOPOLOGY	Flyback converter, current-mode control.
FREQUENCY OF OPERATION	40 kHz (fixed).
HI-POT ISOLATION.....	5300 VDC, input-to-output for one minute. (See Note 2.)
NOISE, RIPPLE and SPIKES.....	1% peak-to-peak, maximum. (See Note 3.)
TRANSIENT RESPONSE	4 ms recovery to within 1% of regulation band with 5% maximum deviation.

ENVIRONMENTAL OPERATING CHARACTERISTICS

TEMPERATURE RANGE	0°C to +70°C
OUTPUT POWER DERATING	Derate output power and current linearly 2%/°C from +50°C to +70°C.
TEMPERATURE COEFFICIENT.....	$\pm 0.05\%/^{\circ}\text{C}$ over the entire operating temperature range.
RELATIVE HUMIDITY	0 to 95%, non-condensing.
ALTITUDE	0 to 10,000 feet.
COOLING	Convection cooling is adequate. When operating in a confined area, moving air is recommended.

STORAGE CHARACTERISTICS

TEMPERATURE RANGE	-40°C to +85°C.
RELATIVE HUMIDITY	0 to 95%, non-condensing.

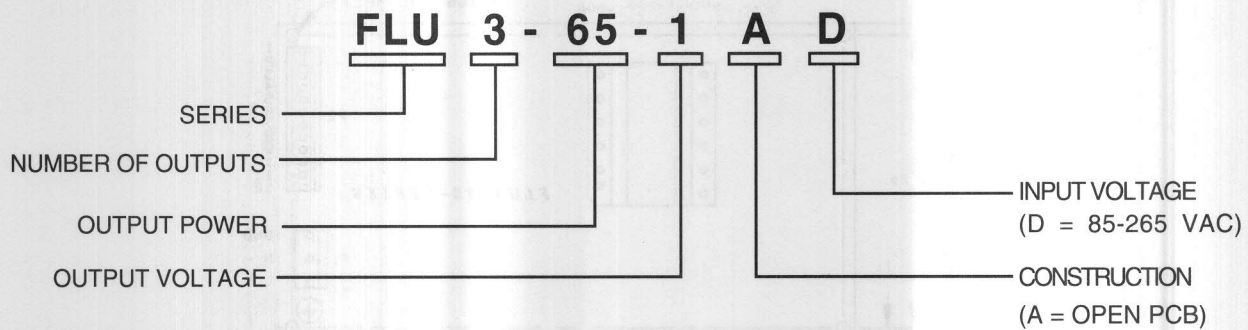
RELIABILITY

MEAN TIME BETWEEN FAILURES.....>175,000 hours. (See Note 4.)

Notes:

1. Replace input line fuse with the same type and rating. Recommended: **2.0A/250 VAC slow-blow** fuse.
2. Hi-Pot isolation is 2200 VDC between input and ground for one minute.
3. Peak-to-peak and RMS metering equipment shall have a 20 MHz response with probes and cables maintaining a frequency response of 20 Hz to 20 MHz. Output ripple and spikes are measured directly at the output terminals of the power supply across a 0.1 μF ceramic capacitor without use of the probe ground.
4. Calculated per the "parts stress" method as outlined in MIL-HDBK 217E. Assumes ground benign and +25°C.

MODEL SELECTION GUIDE



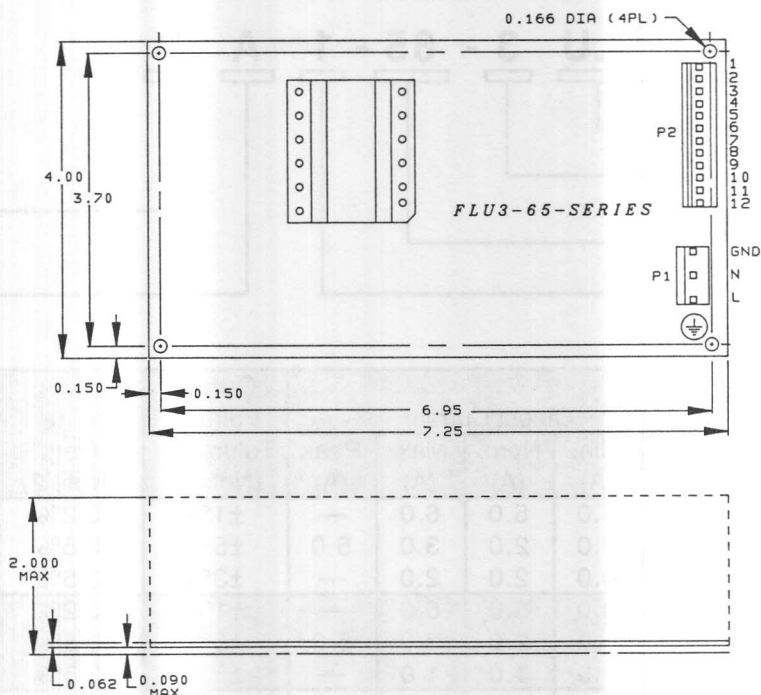
Model Number	Output Voltage		Output Current				Output Voltage Tolerance (Note 1)	Line Reg. (Note 2)	Load Reg. (Note 3)	Cross Reg. (Note 4)
	Output	(V)	Min. (A)	Nom. (A)	Max. (A)	Peak (A)				
FLU3-65-1	V1	+5.0	0.0	5.0	6.0	—	±1%	0.2%	1.0%	—
	V2	+12	0.0	2.0	3.0	5.0	±5%	0.5%	3.0%	4.0%
	V3	5.0 (ISO)	0.0	2.0	2.0	—	±3%	0.5%	1.0%	0.5%
FLU3-65-2	V1	+5.0	0.0	5.0	6.0	—	±1%	0.2%	1.0%	—
	V2	+12	0.0	2.0	3.0	5.0	±5%	0.5%	3.0%	4.0%
	V3	12 (ISO)	0.0	1.0	1.0	—	±5%	0.5%	1.0%	1.0%
FLU3-65-3	V1	+5.0	0.0	5.0	6.0	—	±1%	0.2%	1.0%	—
	V2	+24	0.0	1.0	1.5	2.5	±5%	0.5%	3.0%	4.0%
	V3	5.0 (ISO)	0.0	2.0	2.0	—	±3%	0.5%	1.0%	0.5%
FLU3-65-4	V1	+5.0	0.0	5.0	6.0	—	±1%	0.2%	1.0%	—
	V2	+24	0.0	1.0	1.5	2.5	±5%	0.5%	3.0%	4.0%
	V3	12 (ISO)	0.0	1.0	1.0	—	±5%	0.5%	1.0%	0.5%
FLU3-65-5	V1	+5.0	0.0	5.0	6.0	—	±1%	0.2%	0.5%	—
	V2	+12	0.0	1.7	3.0	—	±5%	0.5%	3.0%	4.0%
	V3	-12	0.0	1.7	3.0	—	±5%	0.5%	4.0%	4.0%
FLU3-65-6	V1	+5.0	0.0	5.0	6.0	—	±1%	0.2%	0.5%	—
	V2	+15	0.0	1.3	2.0	—	±5%	0.5%	3.0%	4.0%
	V3	-15	0.0	1.3	2.0	—	±5%	0.5%	4.0%	4.0%
FLU3-65-7	V1	+5.0	0.0	9.0	10	—	±1%	0.2%	0.5%	—
	V2	+12	0.0	0.9	1.5	—	±5%	0.5%	4.0%	5.0%
	V3	-12	0.0	0.9	1.5	—	±5%	0.5%	5.0%	5.0%
FLU3-65-8	V1	5.0 (ISO)	0.0	10	10	—	±1%	0.2%	0.5%	—
	V2	5.0 (ISO)	0.0	2.0	2.0	—	±3%	0.5%	1.0%	1.0%
	V3	12 (ISO)	0.0	0.5	0.5	—	±5%	0.5%	1.0%	1.0%
FLU3-65-9	V1	+5.0	0.0	9.0	10	—	±1%	0.2%	0.5%	—
	V2	+15	0.0	0.7	1.5	—	±5%	0.5%	4.0%	5.0%
	V3	-15	0.0	0.7	1.5	—	±5%	0.5%	5.0%	5.0%
FLU3-65-10	V1	5.0 (ISO)	0.0	10	10	—	±1%	0.2%	0.5%	—
	V2	12 (ISO)	0.0	1.0	2.0	—	±3%	0.5%	1.0%	1.0%
	V3	12 (ISO)	0.0	0.5	0.5	—	±5%	0.5%	1.0%	1.0%

Notes:

- Output tolerance is measured under nominal load conditions.
- Line regulation is measured under nominal load conditions with the input voltage varied from 85 to 265VAC.
- Load regulation is measured at 115 VAC or 230 VAC input; the output being measured is loaded to 60% of nominal; that load is then varied +40%/-30%. The other outputs are nominally loaded.
- Cross-regulation is tested by changing the load on the primary output (V1) from 50% to 100% of nominal load while measuring the voltage change on the auxiliary output.
- All measurements should be made directly at the terminals of the power supply.
- The FLU3-65 series is approved to UL1950 (File E76127 and File E140439), CSA C22.2-950 (File LR52335), and EN60950/IEC950 (TUV License R9071576).

FLU3-65 SERIES

MECHANICAL OUTLINE AND PIN CONFIGURATION



Notes:

1. Dimensions shown are in inches.
2. Tolerances = 0.00 ±0.01
0.000 ±0.005

PIN-OUT

Pin	FLU3-65-1	FLU3-65-2	FLU3-65-3	FLU3-65-4	FLU3-65-5	FLU3-65-6	FLU3-65-7
1							
2	V1	V1	V1	V1	V1	V1	V1
3							
4							
5	V1	V1	V1	V1	V1	V1	V1
6	COMMON	COMMON	COMMON	COMMON	COMMON	COMMON	COMMON
7	V2 COMMON	V2 COMMON	V2 COMMON	V2 COMMON	V2 COMMON	V2 COMMON	V2 COMMON
8	V2	V2	V2	V2	V2	V2	V2
9	V2	V2	V2	V2	V3 COMMON	V3 COMMON	V3 COMMON
10	-V3 (ISO)	-V3 (ISO)	-V3 (ISO)	-V3 (ISO)	V3	V3	V3
11	+V3 (ISO)	+V3 (ISO)	+V3 (ISO)	+V3 (ISO)	N/A	N/A	N/A
12	N/A	N/A	N/A	N/A	N/A	N/A	N/A

CONNECTORS

Pin	FLU3-65-8	FLU3-65-9	FLU3-65-10	P1 Input Connector		P2 Output Connector	
1	+V1 (ISO)		+V1 (ISO)	MOLEX 09-74-1051		MOLEX 09-74-1121	
2	+V1 (ISO)	V1	+V1 (ISO)				
3	+V1 (ISO)		+V1 (ISO)				
4	-V1 (ISO)		-V1 (ISO)	Pin Function			
5	-V1 (ISO)	V1	-V1 (ISO)				
6	-V1 (ISO)	COMMON	-V1 (ISO)				
7	-V3 (ISO)	V2 COMMON	-V3 (ISO)	MOLEX Mating Connector:		MOLEX Mating Connector:	
8	+V3 (ISO)	V2	+V3 (ISO)				
9	-V2 (ISO)	V3 COMMON	-V2 (ISO)				
10	-V2 (ISO)	V3	-V2 (ISO)	Housing	09-50-1051	Housing	09-50-1121
11	+V2 (ISO)	N/A	+V2 (ISO)	Crimp		Crimp	
12	+V2 (ISO)	N/A	+V2 (ISO)	Terminal	08-70-1030	Terminal	08-70-1030

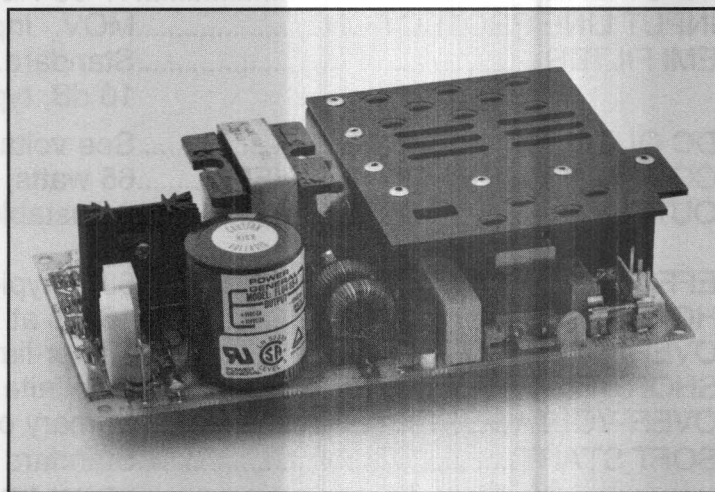
65W QUAD OUTPUT SWITCHING POWER SUPPLIES —UNIVERSAL INPUT RANGE, ULTRA-HIGH RELIABILITY—

FEATURES

- 85-265 VAC Input Voltage Range
- 65 Watts Continuous Output Power
- UL1950 Approved
- CSA C22.2-220/C22.2-950 Approved
- Meets VDE0805
- TUV/EN60950/IEC950 Approved
- VDE/FCC Class B Input Line Filter
- 0% Minimum Load on All Outputs
- Over-Current/Short-Circuit Protection
- 2-Year Warranty
- **Minimum 175,000 Hours MTBF**

APPLICATIONS

- Data Communications Equipment
- Microcomputer-Based Systems
- Industrial Equipment and Instrumentation



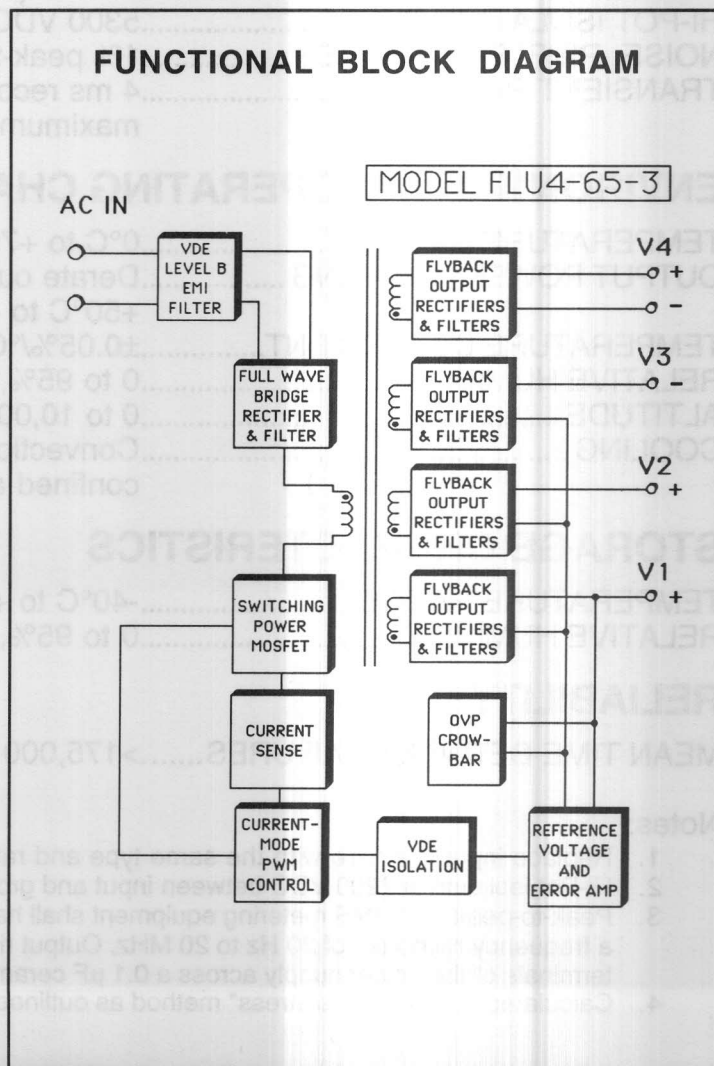
FLU4-65 is a series of four-output, 65-watt, open-frame switching power supplies. Approved to international safety agency standards, the supplies offer high-performance features such as a universal input voltage range of 85 VAC to 265 VAC (or 100-370 VDC) and an on-board EMI filter that complies to VDE/FCC Class B specifications.

Seven models provide dc output of 5.0V and combinations of -5.0V, +5.2V, $\pm 12V$, $\pm 15V$, and $\pm 24V$. Five models offer isolated auxiliary outputs. Standard features include 16-millisecond hold-up time, 5300 VDC input/output isolation and an on-board input line fuse. Other features include soft start, current limiting, indefinite short-circuit and over-voltage protection. Efficiency is 65%, typical; primary load regulation is 1.0 percent or better; the primary is adjustable $\pm 5\%$.

The FLU4-65 series is designed to achieve ultra-high reliability. The minimum MTBF (calculated per the "parts stress" method outlined in MIL-HDBK 217E) is greater than 175,000 hours. Operation is specified over the 0°C to $+70^{\circ}\text{C}$ temperature range with cooling by natural convection.

All models are fabricated on a compact, double-sided 4.0 x 7.25-inch printed circuit board with a maximum component height of 2.0 inches.

FUNCTIONAL BLOCK DIAGRAM



FLU4-65 SERIES

GENERAL SPECIFICATIONS

AC INPUT	Universal input voltage range 85-265 VAC single phase or 100-370 VDC.
INPUT LINE FREQUENCY	47-63 Hz.
INPUT LINE PROTECTION	MOV. Input line fuse provided on-board. (See Note 1.)
EMI FILTER	Standard. Exceeds requirements of VDE/FCC Class B by 10 dB, typical.
DC OUTPUT	See voltage/current rating chart.
CONTINUOUS OUTPUT POWER	65 watts, maximum.
OUTPUT VOLTAGE ADJUST	Adjustable $\pm 5\%$, primary output only.
EFFICIENCY	65%, typical, measured at full load and nominal input.
HOLD-UP TIME	16 ms at 115 VAC, typical.
OVERLOAD PROTECTION	Power-limit circuit.
SHORT-CIRCUIT PROTECTION	Indefinite.
OVER-VOLTAGE PROTECTION	Primary output only, crowbar type (120% of V_{OUT} , typical).
SOFT START	Standard on all models. Prevents output overshoot and power transformer saturation at turn-on.
DESIGN TOPOLOGY	Flyback converter, current-mode control.
FREQUENCY OF OPERATION	40 kHz (fixed).
HI-POT ISOLATION	5300 VDC, input-to-output for one minute. (See Note 2.)
NOISE, RIPPLE and SPIKES	1% peak-to-peak, maximum. (See Note 3.)
TRANSIENT RESPONSE	4 ms recovery to within 1% of regulation band with 5% maximum deviation.

ENVIRONMENTAL OPERATING CHARACTERISTICS

TEMPERATURE RANGE	0°C to +70°C
OUTPUT POWER DERATING	Derate output power and current linearly 2%/°C from +50°C to +70°C.
TEMPERATURE COEFFICIENT	$\pm 0.05\%/^{\circ}\text{C}$ over the entire operating temperature range.
RELATIVE HUMIDITY	0 to 95%, non-condensing.
ALTITUDE	0 to 10,000 feet.
COOLING	Convection cooling is adequate. When operating in a confined area, moving air is recommended.

STORAGE CHARACTERISTICS

TEMPERATURE RANGE	-40°C to +85°C.
RELATIVE HUMIDITY	0 to 95%, non-condensing.

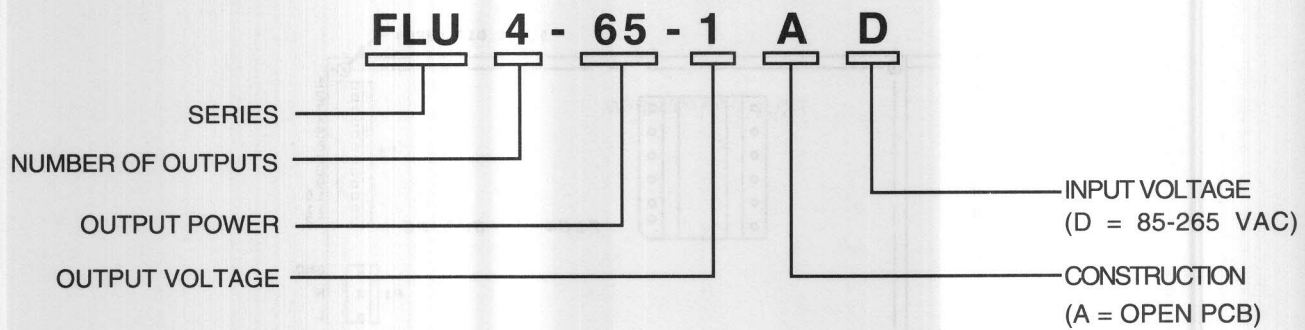
RELIABILITY

MEAN TIME BETWEEN FAILURES.....>175,000 hours. (See Note 4.)

Notes:

1. Replace input line fuse with the same type and rating. Recommended: **2.0A/250 VAC slow-blow fuse.**
2. Hi-Pot isolation is 2200 VDC between input and ground for one minute.
3. Peak-to-peak and RMS metering equipment shall have a 20 MHz response with probes and cables maintaining a frequency response of 20 Hz to 20 MHz. Output ripple and spikes are measured directly at the output terminals of the power supply across a 0.1 μF ceramic capacitor without use of the probe ground.
4. Calculated per the "parts stress" method as outlined in MIL-HDBK 217E. Assumes ground benign and +25°C.

MODEL SELECTION GUIDE



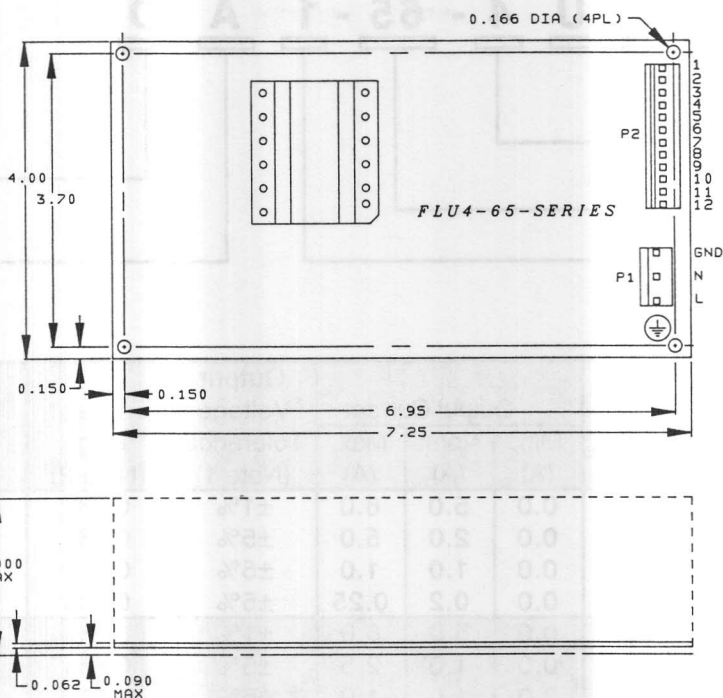
Model Number	Output Voltage		Output Current			Output Voltage Tolerance (Note 1)	Line Reg. (Note 2)	Load Reg. (Note 3)	Cross Reg. (Note 4)
			Min. (A)	Nom. (A)	Max. (A)				
FLU4-65-1	V1	+5.0	0.0	5.0	6.0	±1%	0.2%	1.0%	—
	V2	+12	0.0	2.0	5.0	±5%	0.5%	3.0%	4.0%
	V3	-12	0.0	1.0	1.0	±5%	0.5%	1.0%	1.0%
	V4	-5.0	0.0	0.2	0.25	±5%	0.5%	1.0%	1.0%
FLU4-65-2	V1	+5.0	0.0	5.0	6.0	±1%	0.2%	1.0%	—
	V2	+24	0.0	1.0	2.5	±5%	0.5%	3.0%	4.0%
	V3	-12	0.0	1.0	1.0	±5%	0.5%	1.0%	1.0%
	V4	-5.0	0.0	0.2	0.25	±5%	0.5%	1.0%	1.0%
FLU4-65-3	V1	+5.0	0.0	5.0	6.0	±1%	0.2%	0.5%	—
	V2	+12	0.0	1.5	2.5	±5%	0.5%	3.0%	4.0%
	V3	-12	0.0	1.5	2.5	±5%	0.5%	4.0%	4.0%
	V4	5.0 (ISO)	0.0	1.0	2.0	±3%	0.5%	1.0%	1.0%
FLU4-65-4	V1	+5.0	0.0	5.0	6.0	±1%	0.2%	0.5%	—
	V2	+15	0.0	1.2	2.0	±5%	0.5%	3.0%	4.0%
	V3	-15	0.0	1.2	2.0	±5%	0.5%	4.0%	4.0%
	V4	5.0 (ISO)	0.0	1.0	2.0	±3%	0.5%	1.0%	1.0%
FLU4-65-5	V1	+5.0	0.0	5.0	6.0	±1%	0.2%	0.5%	—
	V2	+12	0.0	1.2	2.5	±5%	0.5%	3.0%	4.0%
	V3	-12	0.0	1.2	2.5	±5%	0.5%	4.0%	4.0%
	V4	24 (ISO)	0.0	0.5	1.0	±5%	0.5%	4.0%	4.0%
FLU4-65-6	V1	+5.0	0.0	9.0	10	±1%	0.2%	1.0%	—
	V2	+12	0.0	0.7	1.5	±5%	0.5%	4.0%	5.0%
	V3	-12	0.0	0.7	1.5	±5%	0.5%	5.0%	5.0%
	V4	5.2 (ISO)	0.0	1.0	1.5	±1%	0.2%	1.0%	0.5%
FLU4-65-7	V1	+5.0	0.0	9.0	10	±1%	0.2%	1.0%	—
	V2	+15	0.0	0.5	1.5	±5%	0.5%	4.0%	5.0%
	V3	-15	0.0	0.5	1.5	±5%	0.5%	5.0%	5.0%
	V4	5.2 (ISO)	0.0	1.0	1.5	±1%	0.2%	1.0%	0.5%

Notes:

- Output tolerance is measured under nominal load conditions.
- Line regulation is measured under nominal load conditions with the input voltage varied from 85 to 265 VAC.
- Load regulation is measured at 115 VAC or 230 VAC input; the output being measured is loaded to 60% of nominal; that load is then varied +40%/-30%. The other outputs are nominally loaded.
- Cross-regulation is tested by changing the load on the primary output (V1) from 50% to 100% of nominal load while measuring the voltage change on the auxiliary output.
- All measurements should be made directly at the terminals of the power supply.
- The FLU4-65 series is approved to UL1950 (File E76127 and E140439), CSA C22.2-950 (File LR52335), and EN60950/IEC950 (TUV License R9071575).

FLU4-65 SERIES

MECHANICAL OUTLINE AND PIN CONFIGURATION



Notes:

1. Dimensions shown are in inches.
2. Tolerances = 0.00 ± 0.01
0.000 ± 0.005

PIN-OUT

Pin	FLU4-65-1	FLU4-65-2	FLU4-65-3	FLU4-65-4	FLU4-65-5	FLU4-65-6	FLU4-65-7
1	V1	V1	V1	V1	V1	V1	V1
2							
3							
4							
5	V1 COMMON	V1 COMMON	V1	V1	V1	V1	V1
6	V1 COMMON	V1 COMMON	COMMON	COMMON	COMMON	COMMON	COMMON
7	V2 COMMON	V2 COMMON	V2 COMMON	V2 COMMON	V2 COMMON	V2 COMMON	V2 COMMON
8	V2	V2	V2	V2	V2	V2	V2
9	V2	V2	V3 COMMON	V3 COMMON	V3 COMMON	V3 COMMON	V3 COMMON
10	V3	V3	V3	V3	V3	V3	V3
11	V3/V4 COMM.	V3/V4 COMM.	-V4 (ISO)	-V4 (ISO)	-V4 (ISO)	-V4 (ISO)	-V4 (ISO)
12	V4	V4	+V4 (ISO)	+V4 (ISO)	+V4 (ISO)	+V4 (ISO)	+V4 (ISO)

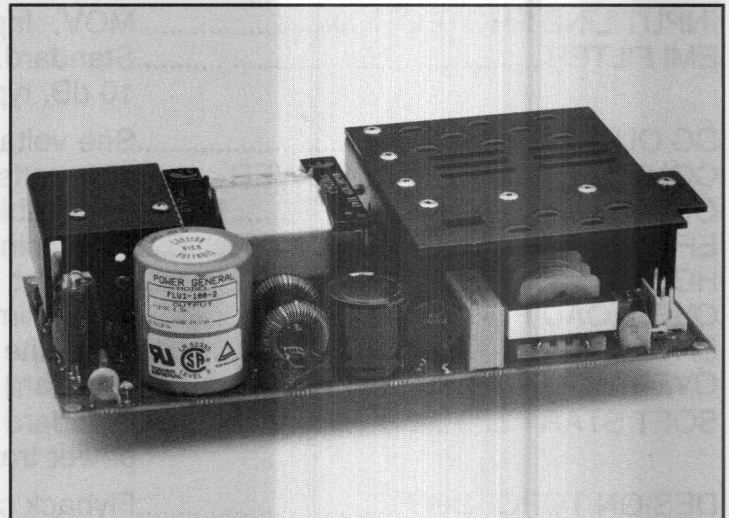
CONNECTORS

P1 Input Connector		P2 Output Connector	
MOLEX 09-74-1051		MOLEX 09-74-1121	
Pin	Function		
1	AC Neutral		
2	AC Line		
3	Ground		
MOLEX Mating Connector:		MOLEX Mating Connector	
Housing	09-50-1051	Housing	09-50-1121
Crimp Terminal	08-70-1030	Crimp Terminal	08-70-1030

100W SINGLE OUTPUT SWITCHING POWER SUPPLIES —UNIVERSAL INPUT RANGE, ULTRA-HIGH RELIABILITY—

FEATURES

- Universal Input Voltage Range
- 100 Watts Continuous Output Power
- UL1950 Approved
- CSA C22.2-950 Approved
- Meets VDE0805
- TUV/EN60950/IEC950 Approved
- VDE/FCC Class B Input Line Filter
- 0% Minimum Load Requirement
- Over-Current/Short-Circuit Protection
- 2-Year Warranty
- **Minimum 175,000 Hours MTBF**



APPLICATIONS

- Data Communications Equipment
- Microcomputer-Based Systems
- Industrial Equipment

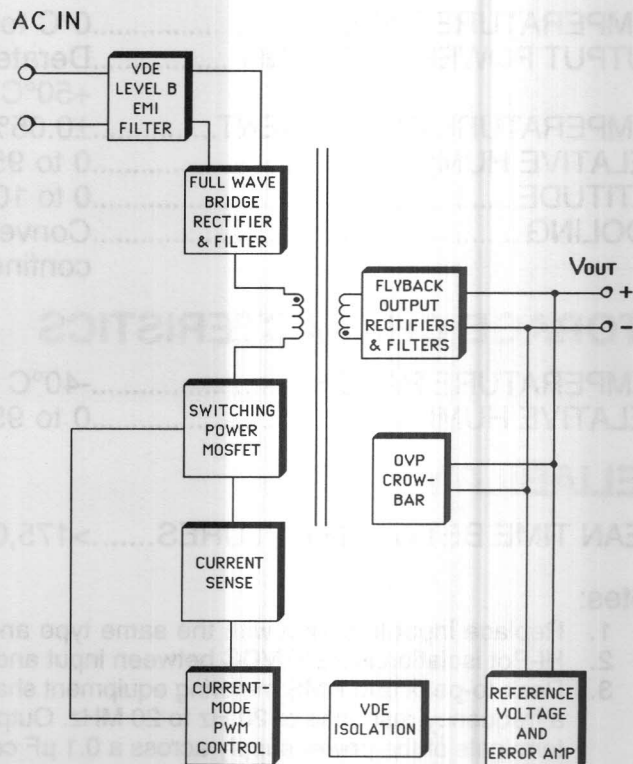
FLU1-100 is a series of single-output, 100-watt, open-frame switching power supplies. Approved to international safety agency standards, these supplies offer high-performance features such as a universal input voltage range of 85 VAC to 265 VAC (or 100-370 VDC) and an on-board EMI filter that complies to VDE/FCC Class B specifications.

Five models provide dc outputs of +5.0V, +12V, +15V, +24V or +28V. Standard features include 16-millisecond hold-up time, 5300 VDC input/output isolation and an on-board input line fuse. The series provides current limiting, soft start, indefinite short-circuit protection and over-voltage protection. Efficiency is 70 percent, minimum; load regulation is ± 0.5 percent; the output is adjustable ± 5 percent.

The FLU1-100 series is designed for ultra-high reliability. The minimum MTBF (calculated per the "parts stress" method outlined in MIL-HDBK 217E) is greater than 175,000 hours. Operation is specified over the temperature range of 0°C to +70°C with cooling by natural convection.

All models are fabricated on a compact, double-sided 4.0 x 8.0-inch printed circuit board with a maximum component height of 2.2 inches.

FUNCTIONAL BLOCK DIAGRAM



FLU1-100 SERIES

GENERAL SPECIFICATIONS

AC INPUT	Universal input voltage range, 85-265 VAC single phase, or 100-370 VDC.
INPUT LINE FREQUENCY	47-63 Hz.
INPUT LINE PROTECTION	MOV. Input line fuse provided on-board. (See Note 1.)
EMI FILTER	Standard. Exceeds requirements of VDE/FCC Class B by 10 dB, typical.
DC OUTPUT	See voltage/current rating chart.
CONTINUOUS OUTPUT POWER	100 watts, maximum.
OUTPUT VOLTAGE ADJUST	Adjustable $\pm 5\%$.
EFFICIENCY	70%, minimum. See voltage/current ratings chart.
HOLD-UP TIME	16 ms at 115 VAC; 40 ms at 230 VAC.
OVERLOAD PROTECTION	Power-limit circuit.
SHORT-CIRCUIT PROTECTION	Indefinite.
OVER-VOLTAGE PROTECTION	Standard on all models, crowbar type, 120% V_{OUT} , typical.
SOFT START	Standard on all models. Prevents output overshoot and power transformer saturation at turn-on.
DESIGN TOPOLOGY	Flyback converter, current-mode control.
FREQUENCY OF OPERATION	25 kHz (fixed).
HI-POT ISOLATION	5300 VDC, input-to-output for one minute. (See Note 2.)
NOISE, RIPPLE and SPIKES	1% peak-to-peak, maximum. (See Note 3.)
TRANSIENT RESPONSE	4 ms recovery to within 1% of regulation band with 5% maximum deviation.

ENVIRONMENTAL OPERATING CHARACTERISTICS

TEMPERATURE RANGE	0°C to +70°C
OUTPUT POWER DERATING	Derate output power and current linearly 2%/°C from +50°C to +70°C.
TEMPERATURE COEFFICIENT	$\pm 0.05\%/^{\circ}\text{C}$ over the entire operating temperature range.
RELATIVE HUMIDITY	0 to 95%, non-condensing.
ALTITUDE	0 to 10,000 feet.
COOLING	Convection cooling is adequate. When operating in a confined area, moving air is recommended.

STORAGE CHARACTERISTICS

TEMPERATURE RANGE	-40°C to +85°C.
RELATIVE HUMIDITY	0 to 95%, non-condensing.

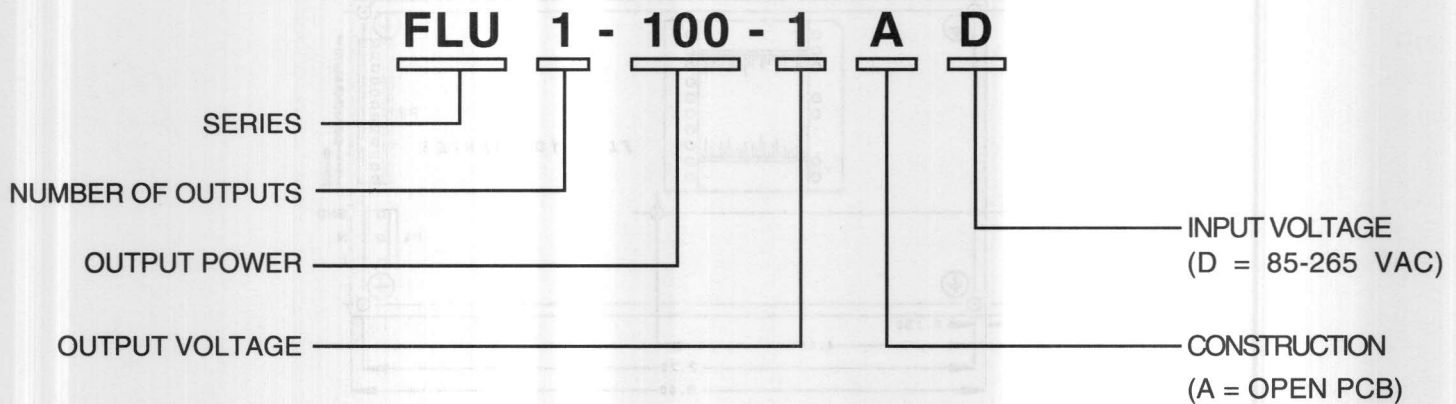
RELIABILITY

MEAN TIME BETWEEN FAILURES.....>175,000 hours. (See Note 4.)

Notes:

1. Replace input line fuse with the same type and rating. Recommended: **3.5A/250 VAC slow-blow** fuse.
2. Hi-Pot isolation is 2200 VDC between input and ground for one minute.
3. Peak-to-peak and RMS metering equipment shall have a 20 MHz response with probes and cables maintaining a frequency response of 20 Hz to 20 MHz. Output ripple and spikes are measured directly at the output terminals of the power supply across a 0.1 μF ceramic capacitor without use of the probe ground.
4. Calculated per the "parts stress" method as outlined in MIL-HDBK 217E. Assumes ground benign and +25°C.

MODEL SELECTION GUIDE



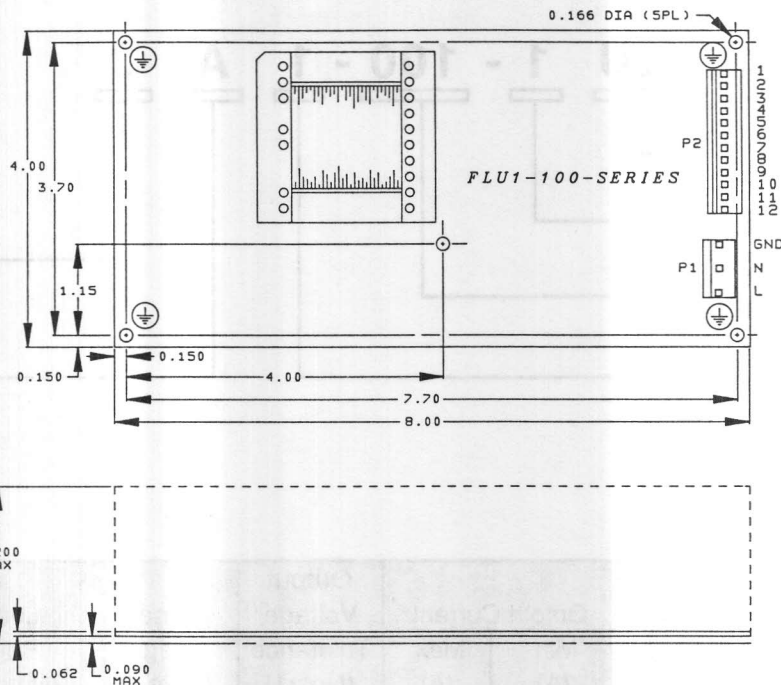
Model Number	Output Voltage (V)	Output Current		Output Voltage Tolerance (Note 1)	Line Reg. (Note 2)	Load Reg. (Note 3)	Efficiency (Note 4)
		Min. (A)	Max. (A)				
FLU1-100-1	+5.0	0.0	20	±1%	0.2%	0.2%	70%
FLU1-100-2	+12	0.0	8.4	±1%	0.2%	0.2%	72%
FLU1-100-3	+15	0.0	6.7	±1%	0.2%	0.2%	74%
FLU1-100-4	+24	0.0	4.2	±1%	0.2%	0.2%	75%
FLU1-100-5	+28	0.0	3.6	±1%	0.2%	0.2%	76%

Notes:

- Output tolerance is measured under nominal load conditions.
- Line regulation is measured under nominal load conditions with the input voltage varied from 85 VAC to 265 VAC.
- Load regulation is measured at 115 VAC or 230 VAC input while the output is loaded to 60% nominal load and varied +40%/-30%.
- Efficiency is measured under full load at nominal input line.
- All measurements should be made directly at the terminals of the power supply.
- The FLU1-100 series is approved to UL1950 (File E140439), CSA C22.2-950 (File LR52335), and EN60950/IEC950 (TUV License R9171540).

FLU1-100 SERIES

MECHANICAL OUTLINE AND PIN CONFIGURATION



Notes:

1. Dimensions shown are in inches.
2. Tolerances = 0.00 ±0.01
0.000 ±0.005
3. If remote sensing is *not* used, tie pins 1 and 2 together and tie pins 11 and 12 together.

PIN-OUT

Pin	FLU1-100-1	FLU1-100-2	FLU1-100-3	FLU1-100-4	FLU1-100-5
1	- SENSE	- SENSE	- SENSE	- SENSE	- SENSE
2	COMMON	COMMON	COMMON	COMMON	COMMON
3					
4					
5					
6					
7	5.0V/20A	12V/8.4A	15V/6.6A	24V/4.2A	28V/3.8A
8					
9					
10					
11					
12	+ SENSE	+ SENSE	+ SENSE	+ SENSE	+ SENSE

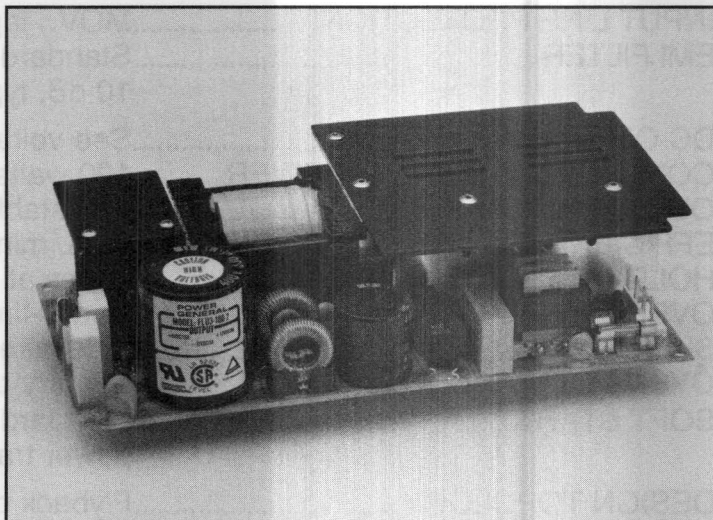
CONNECTORS

<u>P1 Input Connector</u>		<u>P2 Output Connector</u>	
MOLEX 09-74-1051		MOLEX 09-74-1121	
<u>Pin</u>	<u>Function</u>		
1	AC Line		
2	AC Neutral		
3	Ground		
MOLEX Mating Connector		MOLEX Mating Connector	
Housing	09-50-1051	Housing	09-50-1121
Crimp Terminal	08-70-1030	Crimp Terminal	08-70-1030

100W TRIPLE OUTPUT SWITCHING POWER SUPPLIES —UNIVERSAL INPUT RANGE, ULTRA-HIGH RELIABILITY—

FEATURES

- Universal Input Voltage Range
- 100 Watts Continuous Output Power
- UL1950 Approved
- CSA C22.2-220/C22.2-950 Approved
- Meets VDE0805
- TUV/EN60950/IEC950 Approved
- VDE/FCC Class B Input Line Filter
- 0% Minimum Load on All Outputs
- Over-Current Protection
- Short-Circuit Protection
- 2-Year Warranty
- **Minimum 165,000 Hours MTBF**



APPLICATIONS

- Data Communications Equipment
- Microcomputer-Based Systems
- Industrial Equipment and Instrumentation

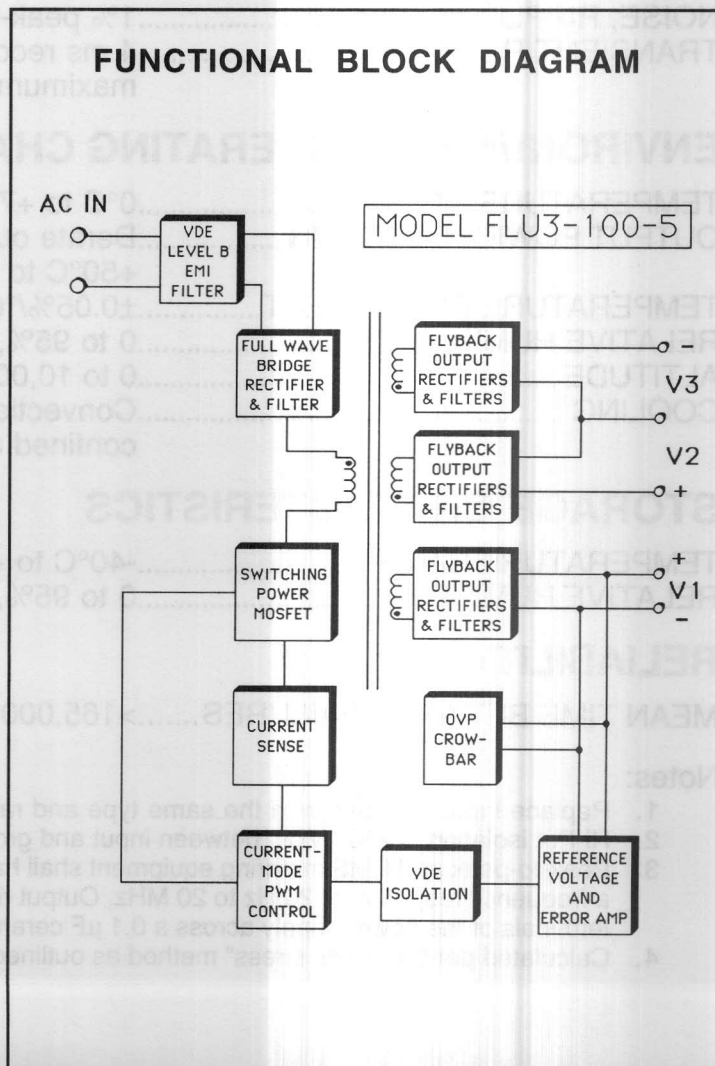
FLU3-100 is a series of three-output, 100-watt, open-frame switching power supplies. Approved to international safety agency standards, these supplies offer high-performance features such as a universal input voltage range of 85 VAC to 265 VAC (or 100-370 VDC) and an on-board EMI filter that complies to VDE/FCC Class B specifications.

Six models provide dc output of +5.0V and combinations of $\pm 12V$, $\pm 15V$, and $\pm 24V$. Standard features include 16-millisecond hold-up time, 5300 VDC input/output isolation and an on-board input line fuse. The series provides current limiting, soft start, indefinite short-circuit protection and over-voltage protection. The series' efficiency rating is 65 percent, minimum; primary load regulation is 1.0 percent; the primary is adjustable ± 5 percent.

The FLU3-100 series is designed for ultra-high reliability. The minimum MTBF (calculated per the "parts stress" method outlined in MIL-HDBK 217E) is greater than 165,000 hours. Operation is specified over the temperature range of 0°C to $+70^{\circ}\text{C}$ with cooling by natural convection.

All models are fabricated on a compact, double-sided 4.0 x 8.0-inch printed circuit board with a maximum component height of 2.2 inches.

FUNCTIONAL BLOCK DIAGRAM



FLU3-100 SERIES

GENERAL SPECIFICATIONS

AC INPUT	Universal input voltage range, 85-265 VAC single phase, or 100-370 VDC.
INPUT LINE FREQUENCY	47-63 Hz.
INPUT LINE PROTECTION	MOV. Input line fuse provided on-board. (See Note 1.)
EMI FILTER	Standard. Exceeds requirements of VDE/FCC Class B by 10 dB, typical.
DC OUTPUT	See voltage/current rating chart.
CONTINUOUS OUTPUT POWER	100 watts, maximum.
OUTPUT VOLTAGE ADJUST	Adjustable $\pm 5\%$.
EFFICIENCY	65%, minimum.
HOLD-UP TIME	16 ms at 115 VAC; 40 ms at 230 VAC.
OVERLOAD PROTECTION	Power-limit circuit.
SHORT-CIRCUIT PROTECTION	Indefinite.
OVER-VOLTAGE PROTECTION	Primary output only, crowbar type, 120% V_{OUT} , typical.
SOFT START	Standard on all models. Prevents output overshoot and power transformer saturation at turn-on.
DESIGN TOPOLOGY	Flyback converter, current-mode control.
FREQUENCY OF OPERATION	25 kHz (fixed).
HI-POT ISOLATION	5300 VDC, input-to-output for one minute. (See Note 2.)
NOISE, RIPPLE and SPIKES	1% peak-to-peak, maximum. (See Note 3.)
TRANSIENT RESPONSE	4 ms recovery to within 1% of regulation band with 5% maximum deviation.

ENVIRONMENTAL OPERATING CHARACTERISTICS

TEMPERATURE RANGE	0°C to +70°C
OUTPUT POWER DERATING	Derate output power and current linearly 2%/°C from +50°C to +70°C.
TEMPERATURE COEFFICIENT	$\pm 0.05\%/^{\circ}\text{C}$ over the entire operating temperature range.
RELATIVE HUMIDITY	0 to 95%, non-condensing.
ALTITUDE	0 to 10,000 feet.
COOLING	Convection cooling is adequate. When operating in a confined area, moving air is recommended.

STORAGE CHARACTERISTICS

TEMPERATURE RANGE	-40°C to +85°C.
RELATIVE HUMIDITY	0 to 95%, non-condensing.

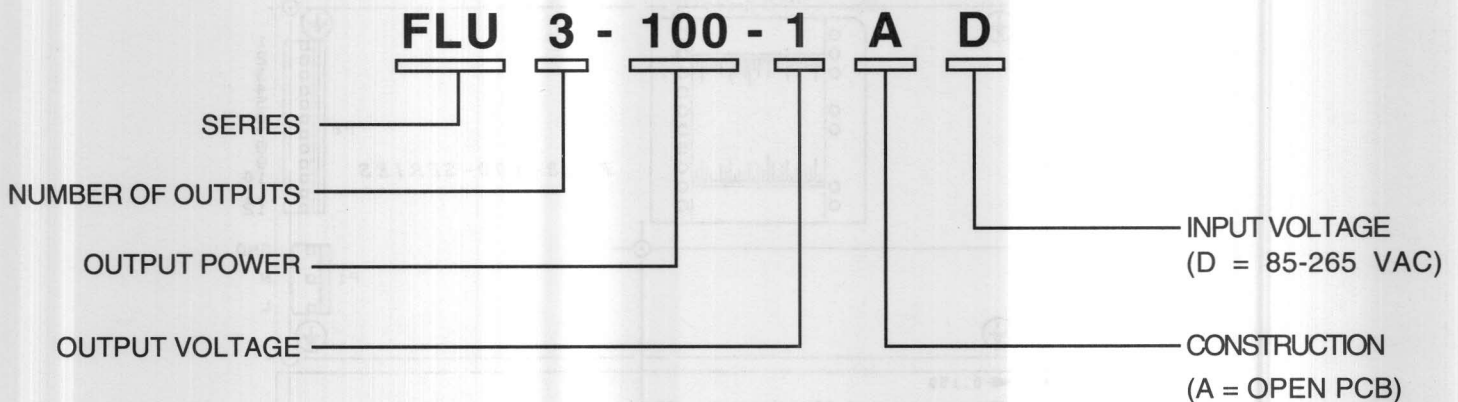
RELIABILITY

MEAN TIME BETWEEN FAILURES.....>165,000 hours. (See Note 4.)

Notes:

1. Replace input line fuse with the same type and rating. Recommended: **3.5A/250 VAC slow-blow** fuse.
2. Hi-Pot isolation is 2200 VDC between input and ground for one minute.
3. Peak-to-peak and RMS metering equipment shall have a 20 MHz response with probes and cables maintaining a frequency response of 20 Hz to 20 MHz. Output ripple and spikes are measured directly at the output terminals of the power supply across a 0.1 μF ceramic capacitor without use of the probe ground.
4. Calculated per the "parts stress" method as outlined in MIL-HDBK 217E. Assumes ground benign and +25°C.

MODEL SELECTION GUIDE



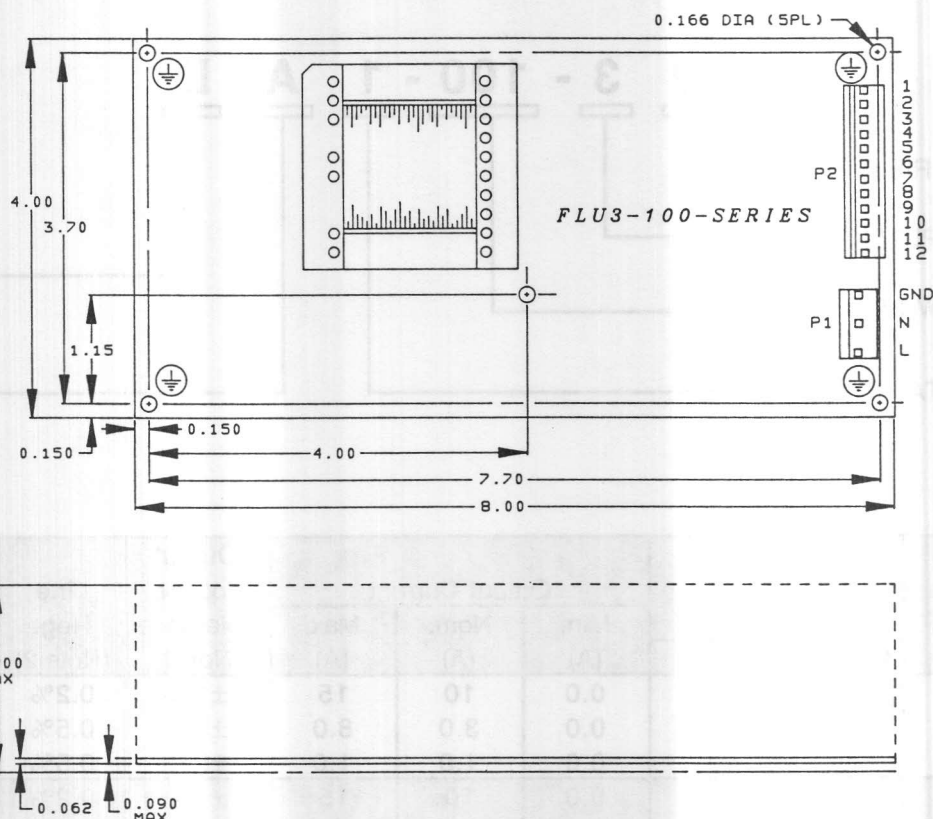
Model Number	Output Voltage		Output Current			Output Voltage Tolerance (Note 1)	Line Reg. (Note 2)	Load Reg. (Note 3)	Cross-Reg. (Note 4)
			Min.	Nom.	Max.				
	Output	(V)	(A)	(A)	(A)				
FLU3-100-1	V1	+5.0	0.0	10	15	±1%	0.2%	1.0%	—
	V2	+12	0.0	3.0	8.0	±5%	0.5%	3.0%	3.0%
	V3	-5.0	0.0	1.0	1.0	±5%	0.5%	1.0%	0.5%
FLU3-100-2	V1	+5.0	0.0	10	15	±1%	0.2%	1.0%	—
	V2	+12	0.0	3.0	8.0	±5%	0.5%	3.0%	3.0%
	V3	-12	0.0	1.0	1.0	±5%	0.5%	1.0%	0.5%
FLU3-100-3	V1	+5.0	0.0	10	15	±1%	0.2%	1.0%	—
	V2	+24	0.0	1.5	4.0	±5%	1.0%	3.0%	3.0%
	V3	-5.0	0.0	1.0	1.0	±5%	0.2%	1.0%	0.5%
FLU3-100-4	V1	+5.0	0.0	10	15	±1%	0.2%	1.0%	—
	V2	+24	0.0	1.5	4.0	±5%	1.0%	3.0%	3.0%
	V3	-12	0.0	1.0	1.0	±5%	0.2%	1.0%	0.5%
FLU3-100-5	V1	+5.0	0.0	10	15	±1%	0.2%	1.0%	—
	V2	+12	0.0	2.0	3.0	±5%	0.5%	5.0%	4.0%
	V3	-12	0.0	2.0	3.0	±5%	0.5%	5.0%	4.0%
FLU3-100-6	V1	+5.0	0.0	10	15	±1%	0.2%	1.0%	—
	V2	+15	0.0	1.6	2.2	±5%	0.5%	5.0%	4.0%
	V3	-15	0.0	1.6	2.2	±5%	0.5%	5.0%	4.0%

Notes:

1. Output voltage tolerance is measured under nominal load conditions.
2. Line regulation is measured under nominal load conditions with the input voltage varied from 85 to 265 VAC.
3. Load regulation is measured at 115 VAC or 230 VAC input. The output being measured is brought to 60 percent of nominal load; that load current is then varied +40 percent/-30 percent of nominal load. The other output is held at nominal load conditions.
4. Cross-regulation is tested by changing the load on the primary output from 50 percent to 100 percent of nominal load while measuring the voltage change on the auxiliary output.
5. All measurements should be made directly at the terminals of the power supply.
6. The FLU3-100 series is approved to UL1950 (File E140439), CSA C22.2-220/C22.2-950 (File LR52335), and EN60950/IEC950 (TUV License R9171540).

FLU3-100 SERIES

MECHANICAL OUTLINE AND PIN CONFIGURATION



Notes:

- Dimensions shown are in inches.
- Tolerances = 0.00 ± 0.01
0.000 ± 0.005

PIN-OUT

Pin	FLU3-100-1	FLU3-100-2	FLU3-100-3	FLU3-100-4	FLU3-100-5	FLU3-100-6
1						
2	COMMON	COMMON	COMMON	COMMON	COMMON	COMMON
3						
4						
5	V1	V1	V1	V1	V1	V1
6						
7	COMMON	COMMON	COMMON	COMMON	COMMON	COMMON
8	V2	V2	V2	V2	V2	V2
9	V2	V2	V2	V2	COMMON	COMMON
10	V3	V3	V3	V3	V3	V3
11	COMMON	COMMON	COMMON	COMMON	N/A	N/A
12	N/A	N/A	N/A	N/A		

CONNECTORS

P1 Input Connector

MOLEX 09-74-1051

Pin	Function
1	AC Line
2	AC Neutral
3	Ground

MOLEX Mating Connector:

Housing 09-50-1051

Crimp Terminal 08-70-1030

P2 Output Connector

MOLEX 09-74-1121

MOLEX Mating Connector

Housing 09-50-1121

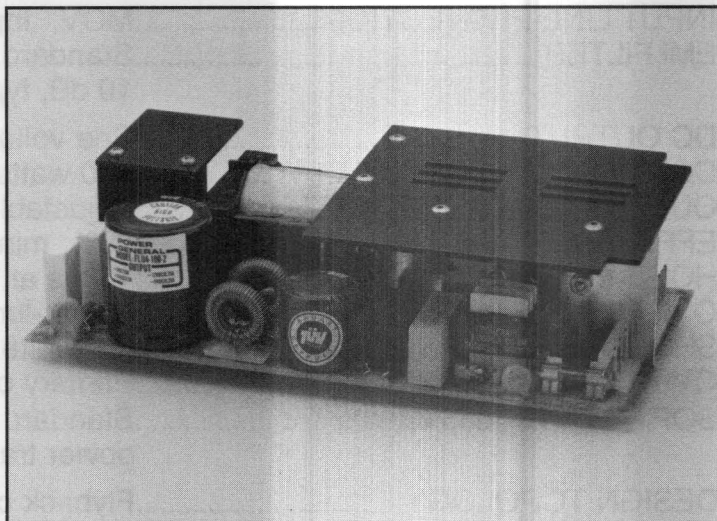
Crimp Terminal 08-70-1030

100W QUAD OUTPUT SWITCHING POWER SUPPLIES

—UNIVERSAL INPUT RANGE, ULTRA-HIGH RELIABILITY—

FEATURES

- Universal Input Voltage Range
- 100 Watts Continuous Output Power
- UL1950 Approved
- CSA C22.2-220/C22.2-950 Approved
- Meets VDE0805
- TUV/EN60950/IEC950 Approved
- 0% Minimum Load on All Outputs
- VDE/FCC Class B Input Line Filter
- Over-Current Protection
- Short-Circuit Protection
- 2-Year Warranty
- **Minimum 165,000 Hours MTBF**



APPLICATIONS

- Data Communications Equipment
- Microcomputer-Based Systems
- Industrial Equipment
- Instrumentation

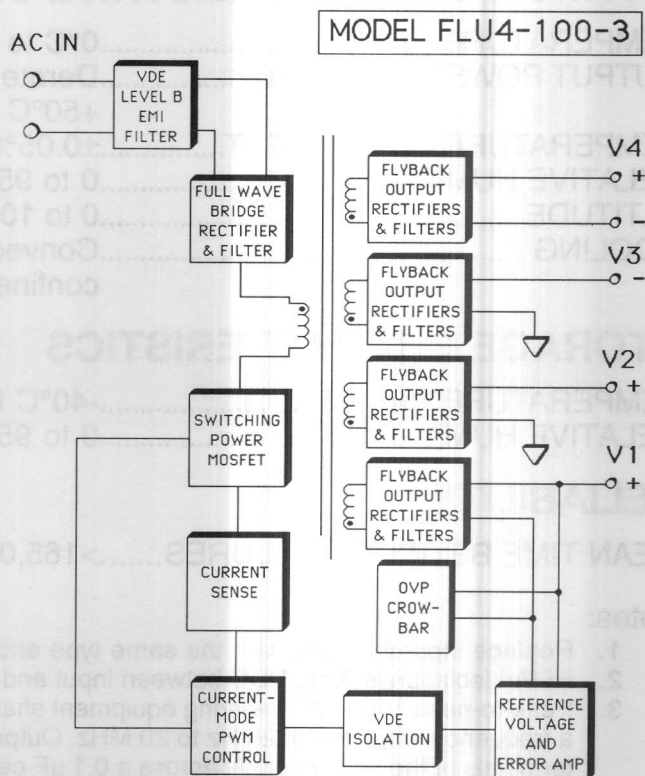
FLU4-100 is a series of four-output, 100-watt, open-frame switching power supplies. Approved to international safety agency standards, these supplies offer high-performance features such as a universal input voltage range of 85 VAC to 265 VAC (or 100-370 VDC) and an on-board EMI filter that complies to VDE/FCC Class B specifications.

Five models provide dc output of +5.0V and combinations of -5.0V, 5.2V, $\pm 12V$, $\pm 15V$, and +24V. Two models, FLU4-100-7 and FLU4-100-8, offer fully isolated outputs with remote load sensing. Standard features on all models include 16-millisecond hold-up time, 5300 VDC input/output isolation and an on-board input line fuse. The series provides current limiting, soft start, indefinite short-circuit protection and over-voltage protection. The series' efficiency rating is 68 percent, minimum; primary load regulation is 1.0 percent; the primary is adjustable by ± 5 percent.

The FLU4-100 series is designed for ultra-high reliability. The minimum MTBF (calculated per the "parts stress" method outlined in MIL-HDBK 217E) is greater than 165,000 hours. Operation is specified over the temperature range of 0°C to +70°C with cooling by natural convection.

All models are fabricated on a compact, double-sided 4.0 x 8.0-inch printed circuit board with a maximum component height of 2.2 inches.

FUNCTIONAL BLOCK DIAGRAM



FLU4-100 SERIES

GENERAL SPECIFICATIONS

AC INPUT	Universal input voltage range, 85-265 VAC single phase, or 100-370 VDC.
INPUT LINE FREQUENCY	47-63 Hz.
INPUT LINE PROTECTION	MOV. Input line fuse provided on-board. (See Note 1.)
EMI FILTER	Standard. Exceeds requirements of VDE/FCC Class B by 10 dB, typical.
DC OUTPUT	See voltage/current rating chart.
CONTINUOUS OUTPUT POWER	100 watts, maximum.
OUTPUT VOLTAGE ADJUST	Adjustable $\pm 5\%$.
EFFICIENCY	68%, minimum.
HOLD-UP TIME	16 ms at 115 VAC; 40 ms at 230 VAC.
OVERLOAD PROTECTION	Power-limit circuit.
SHORT-CIRCUIT PROTECTION	Indefinite.
OVER-VOLTAGE PROTECTION	Primary output only, crowbar type, 120% V_{OUT} , typical.
SOFT START	Standard on all models. Prevents output overshoot and power transformer saturation at turn-on.
DESIGN TOPOLOGY	Flyback converter, current-mode control.
FREQUENCY OF OPERATION	25 kHz (fixed).
HI-POT ISOLATION	5300 VDC, input-to-output for one minute. (See Note 2.)
NOISE, RIPPLE and SPIKES	1% peak-to-peak, maximum. (See Note 3.)
TRANSIENT RESPONSE	4 ms recovery to within 1% of regulation band with 5% maximum deviation.

ENVIRONMENTAL OPERATING CHARACTERISTICS

TEMPERATURE RANGE	0°C to +70°C
OUTPUT POWER DERATING	Derate output power and current linearly 2%/°C from +50°C to +70°C.
TEMPERATURE COEFFICIENT	$\pm 0.05\%/^{\circ}\text{C}$ over the entire operating temperature range.
RELATIVE HUMIDITY	0 to 95%, non-condensing.
ALTITUDE	0 to 10,000 feet.
COOLING	Convection cooling is adequate. When operating in a confined area, moving air is recommended.

STORAGE CHARACTERISTICS

TEMPERATURE RANGE	-40°C to +85°C.
RELATIVE HUMIDITY	0 to 95%, non-condensing.

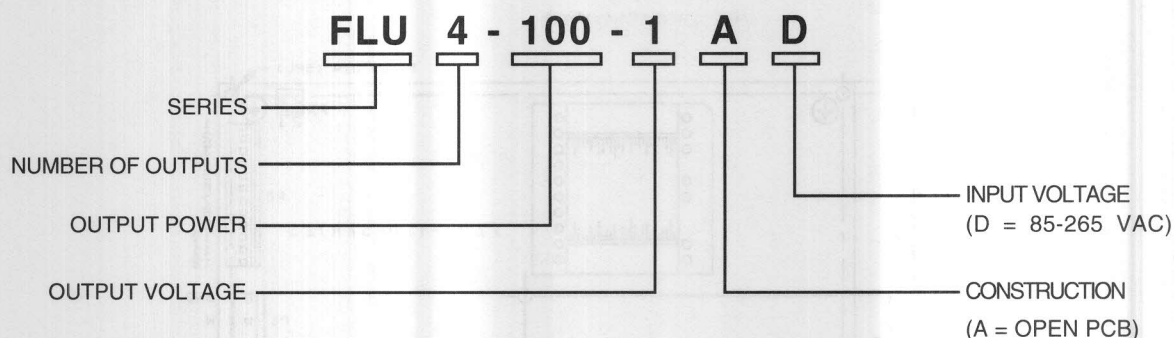
RELIABILITY

MEAN TIME BETWEEN FAILURES.....>165,000 hours. (See Note 4.)

Notes:

1. Replace input line fuse with the same type and rating. Recommended: **3.5A/250 VAC slow-blow** fuse.
2. Hi-Pot isolation is 2200 VDC between input and ground for one minute.
3. Peak-to-peak and RMS metering equipment shall have a 20 MHz response with probes and cables maintaining a frequency response of 20 Hz to 20 MHz. Output ripple and spikes are measured directly at the output terminals of the power supply across a 0.1 μF ceramic capacitor without use of the probe ground.
4. Calculated per the "parts stress" method as outlined in MIL-HDBK 217E. Assumes ground benign and +25°C.

MODEL SELECTION GUIDE



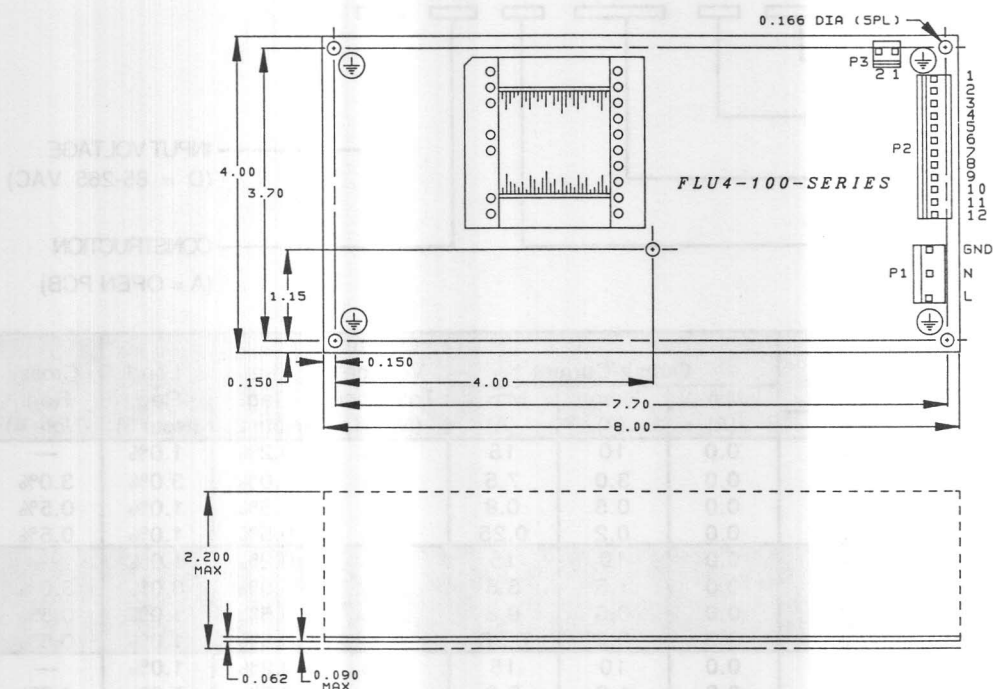
Model Number	Output Voltage		Output Current			Output Voltage Tolerance (Note 1)	Line Reg. (Note 2)	Load Reg. (Note 3)	Cross-Reg. (Note 4)
			Min.	Nom.	Max.				
	Output	(V)	(A)	(A)	(A)				
FLU4-100-1	V1	+5.0	0.0	10	15	±1%	0.2%	1.0%	—
	V2	+12	0.0	3.0	7.5	±5%	1.0%	3.0%	3.0%
	V3	-12	0.0	0.5	0.8	±5%	0.5%	1.0%	0.5%
	V4	-5.0	0.0	0.2	0.25	±5%	0.5%	1.0%	0.5%
FLU4-100-2	V1	+5.0	0.0	10	15	±1%	0.2%	1.0%	—
	V2	+24	0.0	1.5	3.5	±5%	1.0%	3.0%	3.0%
	V3	-12	0.0	0.5	0.8	±5%	0.5%	1.0%	0.5%
	V4	-5.0	0.0	0.2	0.25	±5%	0.5%	1.0%	0.5%
FLU4-100-3	V1	+5.0	0.0	10	15	±1%	0.2%	1.0%	—
	V2	+12	0.0	1.8	3.0	±5%	0.5%	5.0%	4.0%
	V3	-12	0.0	1.8	3.0	±5%	0.5%	5.0%	4.0%
	V4	5.0 (ISO)	0.0	1.0	2.0	±3%	0.2%	1.0%	0.2%
FLU4-100-4	V1	+5.0	0.0	10	15	±1%	0.2%	1.0%	—
	V2	+15	0.0	1.5	2.2	±5%	0.5%	5.0%	4.0%
	V3	-15	0.0	1.5	2.2	±5%	0.5%	5.0%	4.0%
	V4	5.0 (ISO)	0.0	1.0	2.0	±3%	0.2%	1.0%	0.2%
FLU4-100-5	V1	+5.0	0.0	10	15	±1%	0.2%	1.0%	—
	V2	+12	0.0	1.0	3.0	±5%	0.5%	5.0%	4.0%
	V3	-12	0.0	1.0	3.0	±5%	0.5%	5.0%	4.0%
	V4	24 (ISO)	0.0	1.0	2.0	±5%	0.5%	5.0%	4.0%
FLU4-100-6	V1	+5.0	0.0	10	15	±1%	0.2%	1.0%	—
	V2	+15	0.0	0.8	2.2	±5%	0.5%	5.0%	4.0%
	V3	-15	0.0	0.8	2.2	±5%	0.5%	5.0%	4.0%
	V4	24 (ISO)	0.0	1.0	2.0	±5%	0.5%	5.0%	4.0%
FLU4-100-7	V1	5.0 (ISO)	0.0	15	18	±1%	0.2%	1.0%	—
	V2	12 (ISO)	0.0	0.5	0.8	±3%	0.2%	1.0%	1.0%
	V3	12 (ISO)	0.0	0.5	0.8	±3%	0.2%	1.0%	1.0%
	V4	5.2 (ISO)	0.0	2.0	3.0	±1%	0.2%	1.0%	1.0%
FLU4-100-8	V1	5.0 (ISO)	0.0	15	18	±1%	0.2%	1.0%	—
	V2	15 (ISO)	0.0	0.5	0.8	±3%	0.2%	1.0%	1.0%
	V3	15 (ISO)	0.0	0.5	0.8	±3%	0.2%	1.0%	1.0%
	V4	5.2 (ISO)	0.0	2.0	3.0	±1%	0.2%	1.0%	1.0%

Notes:

- Output voltage tolerance is measured under nominal load conditions.
- Line regulation is measured under nominal load conditions with the input voltage varied from 85 VAC to 265 VAC.
- Load regulation is measured at 115 VAC or 230 VAC input. The output being measured is brought to 60 percent of nominal load; that load current is then varied +40 percent/-30 percent of nominal load. The other outputs are held at nominal load conditions.
- Cross-regulation is tested by changing the load on the primary output from 50 percent to 100 percent of nominal load while measuring the voltage change on the auxiliary output.
- All measurements should be made directly at the terminals of the power supply.
- The FLU4-100 series is approved to UL1950 (File E140439), CSA C22.2-220/C22.2-950 (File LR52335), and EN60950/IEC950 (TUV License R9171540).

FLU4-100 SERIES

MECHANICAL OUTLINE AND PIN CONFIGURATION



Notes:

1. Dimensions shown are in inches.
2. Tolerances = 0.00 ± 0.01
0.000 ± 0.005

PIN-OUT

Pin	FLU4-100-1	FLU4-100-2	FLU4-100-3	FLU4-100-4	FLU4-100-5	FLU4-100-6	FLU4-100-7	FLU4-100-8
1	COMMON	COMMON	COMMON	COMMON	COMMON	COMMON	- V1 (ISO)	- V1(ISO)
2								
3								
4	V1	V1	V1	V1	V1	V1	+ V1(ISO)	+ V1(ISO)
5								
6								
7	COMMON	COMMON	COMMON	COMMON	COMMON	COMMON	- V2 (ISO)	- V2 (ISO)
8	V2	V2	V2	V2	V2	V2	+ V2 (ISO)	+ V2 (ISO)
9	V2	V2	COMMON	COMMON	COMMON	COMMON	- V3 (ISO)	- V3 (ISO)
10	V3	V3	V3	V3	V3	V3	+ V3 (ISO)	+ V3 (ISO)
11	COMMON	COMMON	- V4 (ISO)	- V4 (ISO)	- V4 (ISO)	- V4 (ISO)	- V4 (ISO)	- V4 (ISO)
12	V4	V4	+ V4 (ISO)	+ V4 (ISO)	+ V4 (ISO)	+ V4 (ISO)	+ V4 (ISO)	+ V4 (ISO)

CONNECTORS

P1 Input Connector MOLEX 09-74-1051		P2 Output Connector MOLEX 09-74-1121		P3 Remote Sense Conn. Models 7 and 8: MOLEX 22-23-2021	
Pin	Function	Pin	Function	Pin	Function
1	AC Line			1	+ SENSE
2	AC Neutral			2	- SENSE
3	Ground				
MOLEX Mating Connector: Housing 09-50-1051 Crimp Term. 08-70-1030		MOLEX Mating Connector: Housing 09-50-1121 Crimp Term. 08-70-1030		MOLEX Mating Connector: Housing 22-01-2027 Crimp Term. 16-02-1115	

150W QUAD OUTPUT SWITCHING POWER SUPPLIES —AUTORANGING INPUT, ULTRA-HIGH RELIABILITY—

FEATURES

- 90-265 VAC Input Voltage Range
- 150 Watts Continuous Output Power
- UL1950 Approved
- CSA C22.2-950 Approved
- Meets VDE0805
- TUV/EN60950/IEC950 Approved
- VDE/FCC Class B Input Line Filter
- 0% Minimum Load on All Outputs
- Over-Current/Short-Circuit Protection
- 2-Year Warranty
- **Minimum 165,000 Hours MTBF**

APPLICATIONS

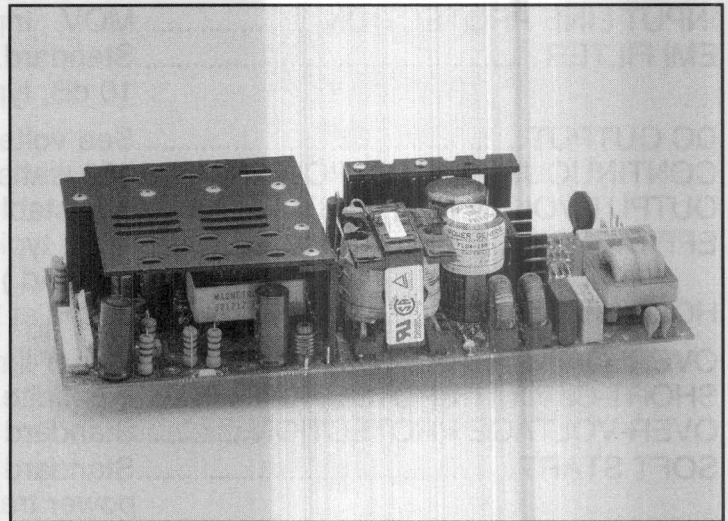
- Data Communications Equipment
- Microcomputer Systems
- Industrial Equipment

FLU4-150 is a series of four-output, 150-watt, open-frame switching power supplies. Approved to international safety agency standards, the supplies offer high-performance features such as auto-ranging inputs with an input voltage range of 90 VAC to 265 VAC and an on-board EMI suppression filter that complies to VDE/FCC Class B specifications.

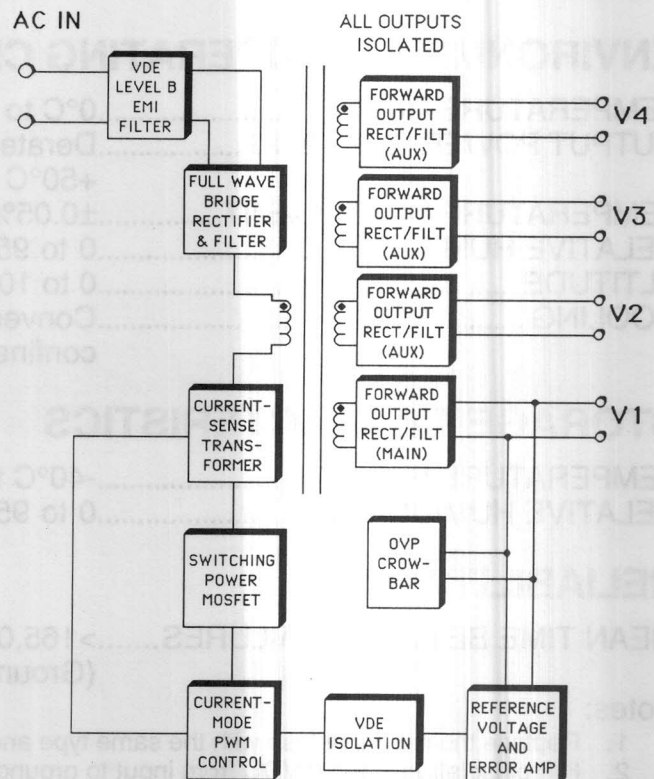
Five models provide dc output of 5.0V and combinations of 5.0V, 12V, 15V and 24V. All outputs are fully isolated. Standard features include 32-millisecond hold-up time, 5300 VDC input/output isolation and an on-board input line fuse. The series provides soft start, indefinite short-circuit protection, over-voltage protection and current limiting. Efficiency is 70 percent, typical; primary output load regulation is 1 percent; the primary is adjustable by ± 5 percent. An optional power-fail warning function is available.

The FLU4-150 series is designed for ultra-high reliability. The minimum MTBF (calculated per the "parts stress" method of MIL-HDBK 217E) is 165,000 hours. Operation is specified over the temperature range of 0°C to +70°C with cooling by natural convection.

All models are fabricated on a double-sided 4.0 x 9.5-inch printed circuit board with a maximum component height of 2.0 inches.



FUNCTIONAL BLOCK DIAGRAM



FLU4-150 SERIES

GENERAL SPECIFICATIONS

AC INPUT	90-265 VAC, single phase.
INPUT LINE FREQUENCY	47-63 Hz.
INPUT LINE PROTECTION	MOV. Input line fuse provided on-board. (See Note 1.)
EMI FILTER	Standard. Exceeds requirements of VDE/FCC Class B by 10 dB, typical.
DC OUTPUT	See voltage/current rating chart.
CONTINUOUS OUTPUT POWER	150 watts, maximum.
OUTPUT VOLTAGE ADJUST	Adjustable $\pm 5\%$, primary output only.
EFFICIENCY	70%, typical. (Nominal input voltage line conditions and full load.)
HOLD-UP TIME	32 ms at 115 VAC, 40 ms at 220 VAC.
OVERLOAD PROTECTION	Power-limit circuit.
SHORT-CIRCUIT PROTECTION	Indefinite.
OVER-VOLTAGE PROTECTION	Standard on all models, crowbar type, 120% V_{OUT} , typical.
SOFT START	Standard on all models. Prevents output overshoot and power transformer saturation at turn-on.
DESIGN TOPOLOGY	Forward converter, current-mode control.
FREQUENCY OF OPERATION	50 kHz (fixed).
HI-POT ISOLATION	5300 VDC, input-to-output for one minute (See Note 2).
NOISE, RIPPLE & SPIKES	1% peak-to-peak, maximum (See Note 3).
TRANSIENT RESPONSE	4 ms recovery to within 1% of regulation band with 5% maximum deviation.
POWER FAIL (OPTIONAL)	TTL-compatible, 4 ms, minimum, before loss of output.

ENVIRONMENTAL OPERATING CHARACTERISTICS

TEMPERATURE RANGE	0°C to +70°C.
OUTPUT POWER DERATING	Derate output power and current linearly 2%/°C from +50°C to +70°C.
TEMPERATURE COEFFICIENT	$\pm 0.05\%/^{\circ}\text{C}$ over the entire operating temperature range.
RELATIVE HUMIDITY	0 to 95%, non-condensing.
ALTITUDE	0 to 10,000 feet.
COOLING	Convection cooling is adequate. When operating in a confined area, moving air is recommended.

STORAGE CHARACTERISTICS

TEMPERATURE RANGE	-40°C to +85°C.
RELATIVE HUMIDITY	0 to 95%, non-condensing.

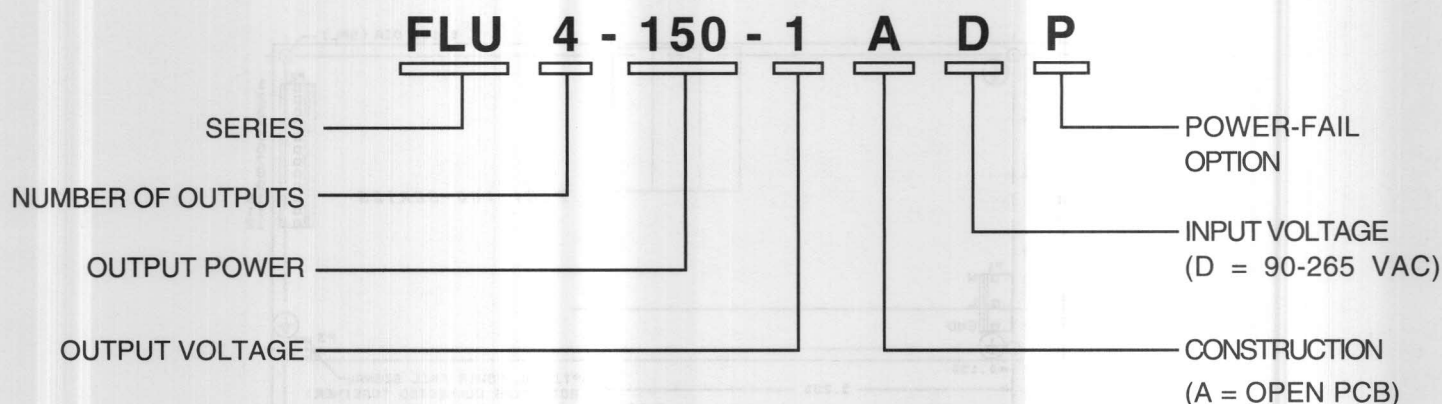
RELIABILITY

MEAN TIME BETWEEN FAILURES	>165,000 Hours, per MIL-HDBK 217E Parts Stress Method. (Ground benign, +25°C.)
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Notes:

1. Replace the input line fuse with the same type and rating. Recommended: **3.5A/250VAC slow-blow fuse.**
2. Hi-pot isolation is 2200 VDC from input to ground for 60 seconds.
3. Peak-to-peak and RMS metering equipment shall have a 20 MHz frequency response with probes and cables maintaining a frequency response of 20 Hz to 20 MHz. Output ripple and spikes are measured directly at the output terminals of the power supply with a 0.1 μF ceramic capacitor without the use of the probe ground clip.

MODEL SELECTION GUIDE



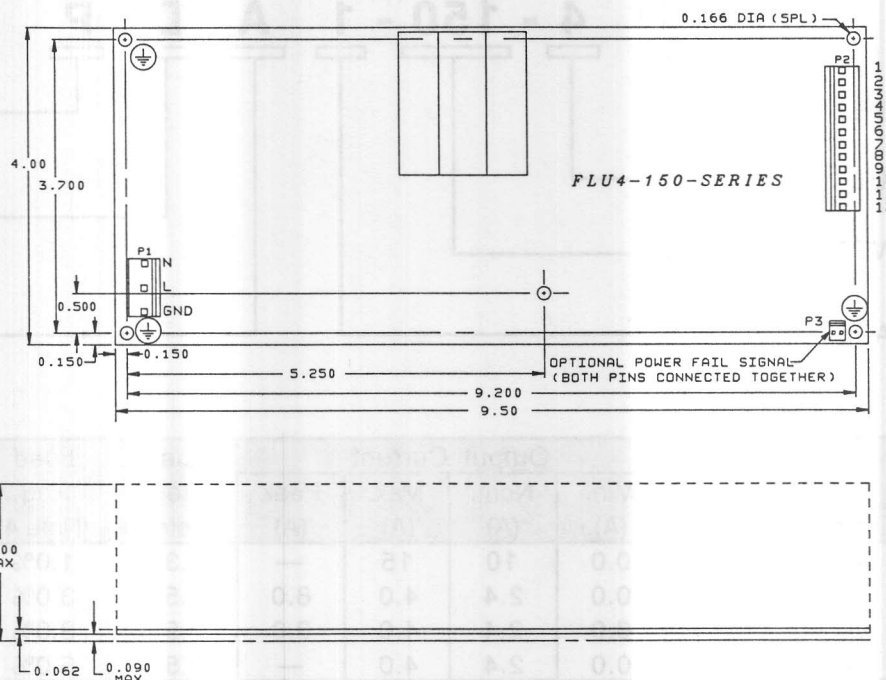
Model Number	Output Voltage		Output Current				Line Reg. (Note 3)	Load Reg. (Note 4)	Cross-Reg. (Note 5)	Error Envelope (Note 6)
			Min.	Nom.	Max.	Peak				
	Output	(V)	(A)	(A)	(A)	(A)				
FLU4-150-1	V1	5.0	0.0	10	15	—	0.3%	1.0%	—	1.0%
	V2	12	0.0	2.4	4.0	8.0	0.5%	3.0%	3.0%	6.0%
	V3	12	0.0	2.4	4.0	8.0	0.5%	3.0%	3.0%	6.0%
	V4	5.0	0.0	2.4	4.0	—	0.5%	5.0%	4.0%	6.0%
FLU4-150-2	V1	5.0	0.0	10	15	—	0.3%	1.0%	—	1.0%
	V2	12	0.0	2.4	4.0	8.0	0.5%	3.0%	3.0%	6.0%
	V3	12	0.0	2.4	4.0	8.0	0.5%	3.0%	3.0%	6.0%
	V4	12	0.0	3.6	6.0	8.0	0.5%	5.0%	4.0%	6.0%
FLU4-150-3	V1	5.0	0.0	10	15	—	0.3%	1.0%	—	1.0%
	V2	12	0.0	2.4	4.0	8.0	0.5%	3.0%	3.0%	6.0%
	V3	12	0.0	2.4	4.0	8.0	0.5%	3.0%	3.0%	6.0%
	V4	15	0.0	2.4	4.0	8.0	0.5%	5.0%	4.0%	6.0%
FLU4-150-4	V1	5.0	0.0	10	15	—	0.3%	1.0%	—	1.0%
	V2	12	0.0	2.4	4.0	8.0	0.5%	3.0%	3.0%	6.0%
	V3	12	0.0	2.4	4.0	8.0	0.5%	3.0%	3.0%	6.0%
	V4	24	0.0	1.5	3.0	4.0	0.5%	5.0%	3.0%	6.0%
FLU4-150-5	V1	5.0	0.0	10	15	—	0.3%	1.0%	—	1.0%
	V2	15	0.0	1.8	3.0	6.0	0.5%	3.0%	3.0%	6.0%
	V3	15	0.0	1.8	3.0	6.0	0.5%	3.0%	3.0%	6.0%
	V4	5.0	0.0	2.4	4.0	—	0.5%	5.0%	4.0%	6.0%

Notes:

1. All outputs are electrically isolated from each other and may be referenced positive or negative.
2. The 12V, 15V, and 24V outputs will accept pulse load currents for a period of less than 60 seconds.
3. Line regulation is measured under nominal load conditions with the input voltage varied from 90 to 265 VAC.
4. Load regulation is measured at 115 VAC or 230 VAC input while the output under test is loaded to 60% of nominal load and varied $\pm 40\%$ of nominal load. Other outputs are held at nominal load.
5. Cross-regulation is tested by changing the load on the primary output (V1) from 8A to 12A while measuring the voltage change on the auxiliary output.
6. Error envelope is measured at nominal line conditions. The primary output (V1) is varied from 8A to 12A while auxiliary outputs are varied from 3A to 1.5A.
7. All measurements should be made directly at the terminals of the power supply.
8. The FLU4-150 series is approved to UL1950 (File E76127 and E140439), CSA 22.2-950 (File LR52335), and EN60950/IEC950 (TUV License R9171474).

FLU4-150 SERIES

MECHANICAL OUTLINE AND PIN CONFIGURATION



Notes:

1. Dimensions shown are in inches.
2. Tolerances = 0.00 \pm 0.01 inch.
0.000 \pm 0.005 inch

PIN-OUT

Pin	FLU4-150-1	FLU4-150-2	FLU4-150-3	FLU4-150-4	FLU4-150-5
1	+V4 (ISO)	+V4 (ISO)	+V4 (ISO)	+V4 (ISO)	+V4 (ISO)
2	-V4 (ISO)	-V4 (ISO)	-V4 (ISO)	-V4 (ISO)	-V4 (ISO)
3	+V3 (ISO)	+V3 (ISO)	+V3 (ISO)	+V3 (ISO)	+V3 (ISO)
4	-V3 (ISO)	-V3 (ISO)	-V3 (ISO)	-V3 (ISO)	-V3 (ISO)
5	-V2 (ISO)	-V2 (ISO)	-V2 (ISO)	-V2 (ISO)	-V2 (ISO)
6	+V2 (ISO)	+V2 (ISO)	+V2 (ISO)	+V2 (ISO)	+V2 (ISO)
7	-V1 (ISO)	-V1 (ISO)	-V1 (ISO)	-V1 (ISO)	-V1 (ISO)
8	(P.F. RTN)	(P.F. RTN)	(P.F. RTN)	(P.F. RTN)	(P.F. RTN)
9					
10					
11	+V1 (ISO)	+V1 (ISO)	+V1 (ISO)	+V1 (ISO)	+V1 (ISO)
12					

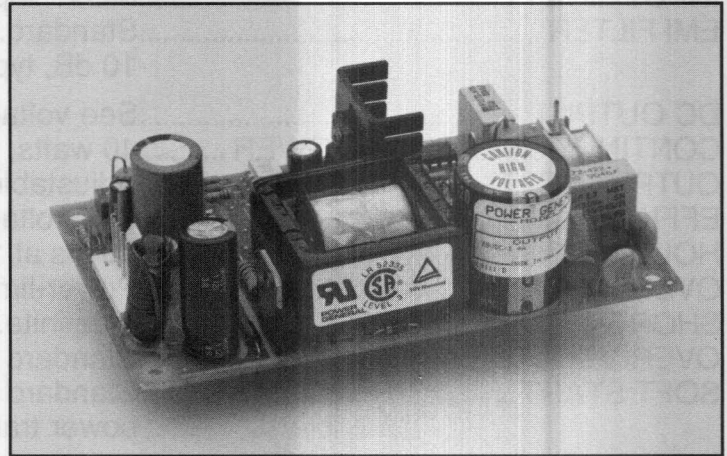
CONNECTORS

P1 Input Connector MOLEX 09-74-1051			P2 Output Connector MOLEX 09-74-1121		P3 Power-Fail Connector MOLEX 22-23-2021	
Pin 1	Pin 2	Pin 3				
AC Neutral	AC Line	Ground				
MOLEX Mating Connector			MOLEX Mating Connector		MOLEX Mating Connector	
Housing	09-50-1051		Housing	09-50-1121	Housing	22-01-2027
Crimp Terminal	08-70-1030		Crimp Terminal	08-70-1030	Crimp Terminal	16-02-1115

40W SINGLE OUTPUT SWITCHING POWER SUPPLIES —UL544 APPROVED, UNIVERSAL INPUT RANGE—

FEATURES

- UL544 Medical Safety Approval
- IEC601/EN60-601 Safety Approval
- Universal Input Voltage Range
- 40 Watts Continuous Output Power
- VDE/FCC Class B Input Line Filter
- Over-Current Protection
- Short-Circuit Protection
- 5700 VDC Input/Output Isolation
- 0% Minimum Load Requirement
- 2-Year Warranty
- **Minimum 220,000 Hours MTBF**



APPLICATIONS

- Medical Equipment
- Dental Equipment
- Laboratory Equipment
- Industrial Instrumentation

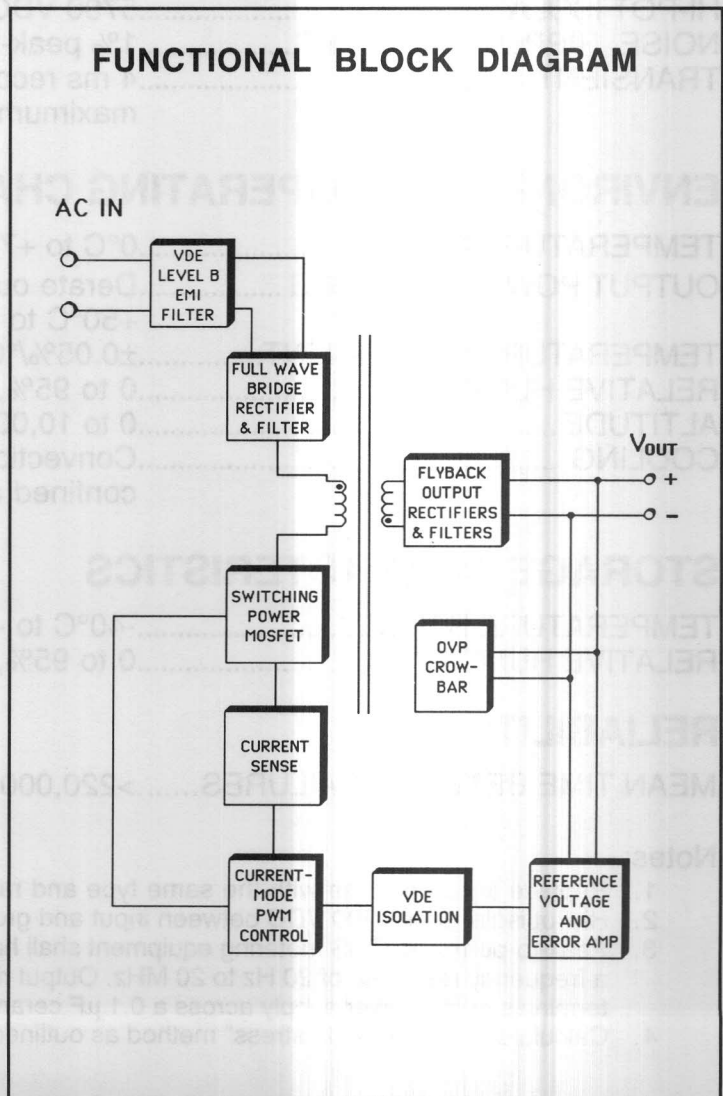
MDU1-40 is a series of single-output, 40-watt, open-frame switching power supplies designed for *non-patient-contact* use in medical, dental and lab applications in which high isolation and ultra-low leakage currents are critical. All models are approved to UL and IEC medical safety standards and offer high-performance features such as a universal input voltage range of 85 VAC to 265 VAC (or 100-370 VDC) and an on-board EMI filter that complies to VDE/FCC Class B specifications.

Six models provide dc output of 5.0V, 9.0V, 12V, 15V, 24V or 28V. Standard features include 16-millisecond hold-up time, 5700 VDC input/output isolation and an on-board input line fuse. The series provides current limiting, soft start, indefinite short-circuit protection and over-voltage protection. Efficiency is 62 percent, minimum; load regulation is 0.5 percent; the output is ± 5 percent adjustable.

The MDU1-40 series is designed for ultra-high reliability. The minimum MTBF (calculated per the "parts stress" method outlined in MIL-HDBK 217E) is greater than 220,000 hours. Operation is specified over the 0°C to +70°C temperature range with cooling by natural convection.

All models are fabricated on a compact 3.0 x 5.0-inch printed circuit board with a maximum component height of 1.5 inches.

FUNCTIONAL BLOCK DIAGRAM



MDU1-40 SERIES

GENERAL SPECIFICATIONS

AC INPUT	Universal input voltage range 85-265 VAC single phase or 100-370 VDC.
INPUT LINE FREQUENCY	47-63 Hz.
INPUT LINE PROTECTION	MOV. Input line fuse provided on-board. (See Note 1.)
EMI FILTER	Standard. Exceeds requirements of VDE/FCC Class B by 10 dB, typical.
DC OUTPUT	See voltage/current rating chart.
CONTINUOUS OUTPUT POWER	40 watts, maximum.
OUTPUT VOLTAGE ADJUST	Adjustable $\pm 5\%$.
EFFICIENCY	See voltage/current ratings chart.
HOLD-UP TIME	16 ms at 115 VAC, 40 ms at 220 VAC.
OVERLOAD PROTECTION	Power-limit circuit.
SHORT-CIRCUIT PROTECTION	Indefinite.
OVER-VOLTAGE PROTECTION	Standard on all models.
SOFT START	Standard on all models. Prevents output overshoot and power transformer saturation at turn-on.
DESIGN TOPOLOGY	Flyback converter, current-mode control.
FREQUENCY OF OPERATION	40 kHz (fixed).
HI-POT ISOLATION	5700 VDC, input-to-output for one minute. (See Note 2.)
NOISE, RIPPLE and SPIKES	1% peak-to-peak, maximum. (See Note 3.)
TRANSIENT RESPONSE	4 ms recovery to within 1% of regulation band with 5% maximum deviation.

ENVIRONMENTAL OPERATING CHARACTERISTICS

TEMPERATURE RANGE	0°C to +70°C
OUTPUT POWER DERATING	Derate output power and current linearly 2%/°C from +50°C to +70°C.
TEMPERATURE COEFFICIENT	$\pm 0.05\%/^{\circ}\text{C}$ over the entire operating temperature range.
RELATIVE HUMIDITY	0 to 95%, non-condensing.
ALTITUDE	0 to 10,000 feet.
COOLING	Convection cooling is adequate. When operating in a confined area, moving air is recommended.

STORAGE CHARACTERISTICS

TEMPERATURE RANGE	-40°C to +85°C.
RELATIVE HUMIDITY	0 to 95%, non-condensing.

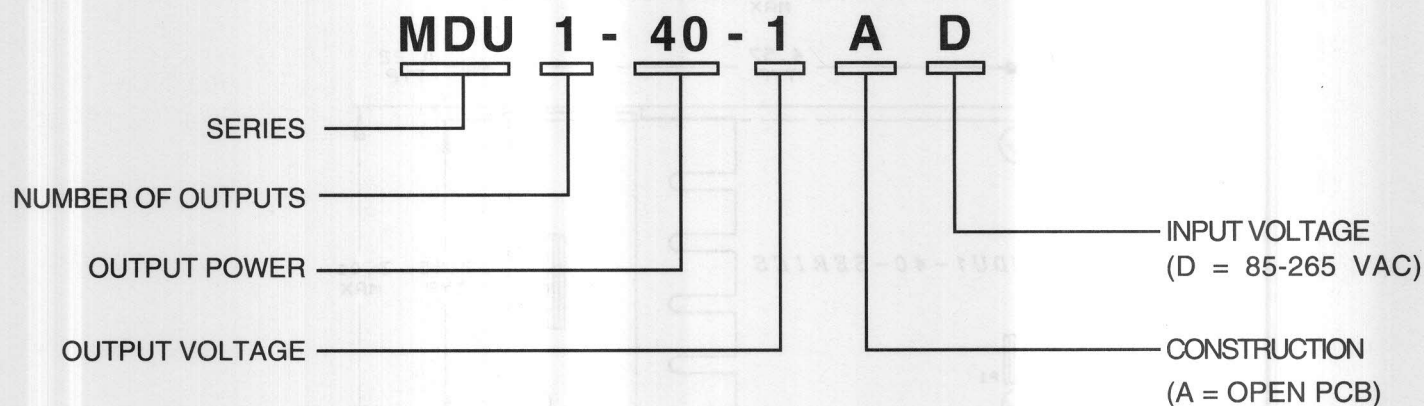
RELIABILITY

MEAN TIME BETWEEN FAILURES.....>220,000 Hours. (See Note 4.)

Notes:

1. Replace input line fuse with the same type and rating. Recommended: **2.0A/250 VAC slow-blow** fuse.
2. Hi-Pot isolation is 2200 VDC between input and ground for one minute.
3. Peak-to-peak and RMS metering equipment shall have a 20 MHz response with probes and cables maintaining a frequency response of 20 Hz to 20 MHz. Output ripple and spikes are measured directly at the output terminals of the power supply across a 0.1 μF ceramic capacitor without use of the probe ground.
4. Calculated per the "parts stress" method as outlined in MIL-HDBK 217E. Assumes ground benign and +25°C.

MODEL SELECTION GUIDE



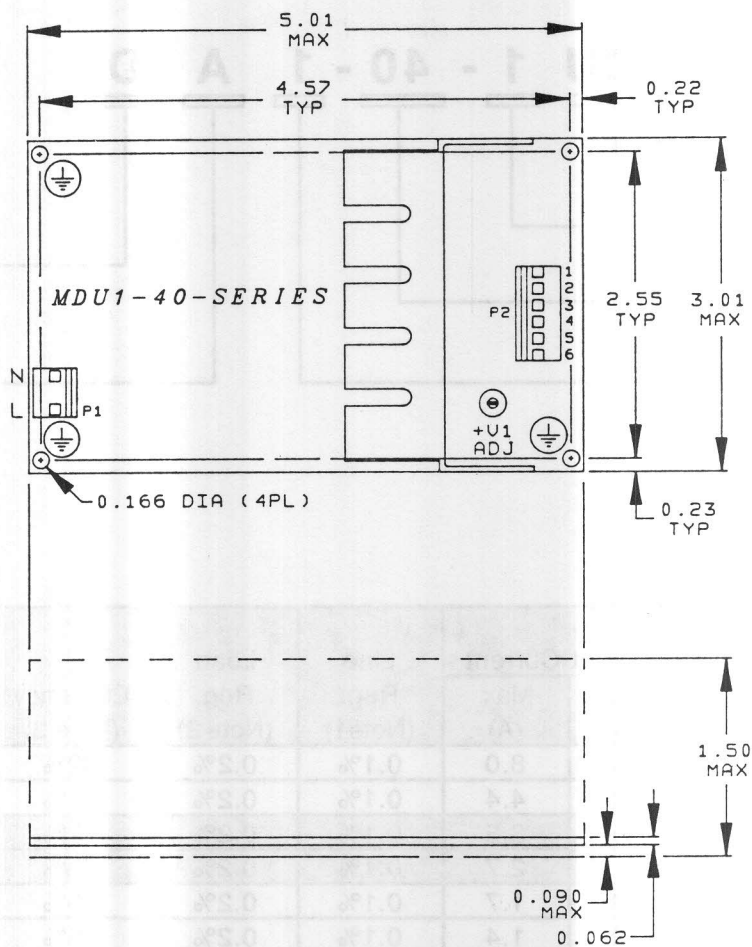
Model Number	Output Voltage (V)	Output Current		Line Reg. (Note 1)	Load Reg. (Note 2)	Efficiency (Note 3)	Output Voltage Tolerance (Note 4)	Max. Leakage Current (μA)
		Min. (A)	Max. (A)					
MDU1-40-1	5.0	0.0	8.0	0.1%	0.2%	62%	±1%	100
MDU1-40-2	9.0	0.0	4.4	0.1%	0.2%	68%	±1%	100
MDU1-40-3	12	0.0	3.3	0.1%	0.2%	72%	±1%	100
MDU1-40-4	15	0.0	2.7	0.1%	0.2%	72%	±1%	100
MDU1-40-5	24	0.0	1.7	0.1%	0.2%	75%	±1%	100
MDU1-40-6	28	0.0	1.4	0.1%	0.2%	75%	±1%	100

Notes:

1. Line regulation is measured under nominal load conditions with the input voltage varied from 85 VAC to 265 VAC.
2. Load regulation is tested by varying the load from 0% to 100% of rated load.
3. Efficiency is measured under full load at nominal input line.
4. Output tolerance is measured under maximum load conditions.
5. All measurements should be made directly at the terminals of the power supply.
6. The MDU1-40 series is approved to UL544 (File E76127).

MDU1-40 SERIES

MECHANICAL OUTLINE AND PIN CONFIGURATION



Notes:

1. Dimensions shown are in inches.
2. Tolerances = 0.00 ±0.01
0.000 ±0.005

PIN-OUT

Pin	MDU1-40-1	MDU1-40-2	MDU1-40-3	MDU1-40-4	MDU1-40-5	MDU1-40-6
1						
2	5.0V/8.00A	9.0V/4.45A	12V/3.35A	15V/2.70A	24V/1.70A	28V/1.45A
3						
4						
5	COMMON	COMMON	COMMON	COMMON	COMMON	COMMON
6						

CONNECTORS

P1 Input Connector

MOLEX 09-74-1031

Pin	Function
1	AC Neutral
2	AC Return

MOLEX Mating Connector

Housing	09-50-1031
Crimp Terminal	08-70-1030

P2 Output Connector

MOLEX 09-74-1061

MOLEX Mating Connector

Housing	09-50-1061
Crimp Terminal	08-70-1030

40W DUAL OUTPUT SWITCHING POWER SUPPLIES

—UL544 APPROVED, UNIVERSAL INPUT RANGE—

FEATURES

- UL544 Medical Safety Approval
- IEC601/EN60-601 Safety Approval
- Universal Input Voltage Range
- 40 Watts Continuous Output Power
- 5700 VDC Input/Output Isolation
- VDE/FCC Class B Input Line Filter
- 0% Minimum Load on Both Outputs
- Over-Current Protection
- Short-Circuit Protection
- 2-Year Warranty
- **Minimum 205,000 Hours MTBF**

APPLICATIONS

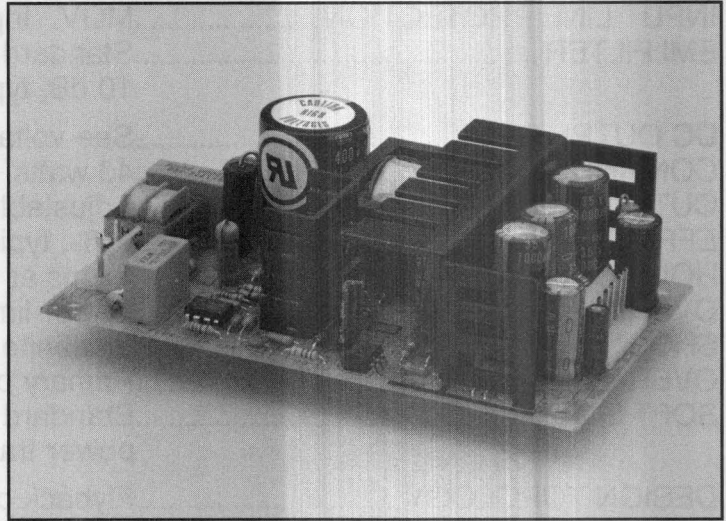
- Medical and Dental Equipment
- Lab Equipment
- Industrial Equipment
- Instrumentation

MDU2-40 is a series of two-output, 40-watt, open-frame switching power supplies. The series is designed for *non-patient-contact* use in medical, dental and laboratory applications in which high isolation and very low leakage currents are critical. All units in the series carry UL and IEC medical safety approval and offer high-performance features such as a universal input voltage range of 85 VAC to 265 VAC (or 100-370 VDC) and an on-board EMI filter that complies to VDE/FCC Class B specifications.

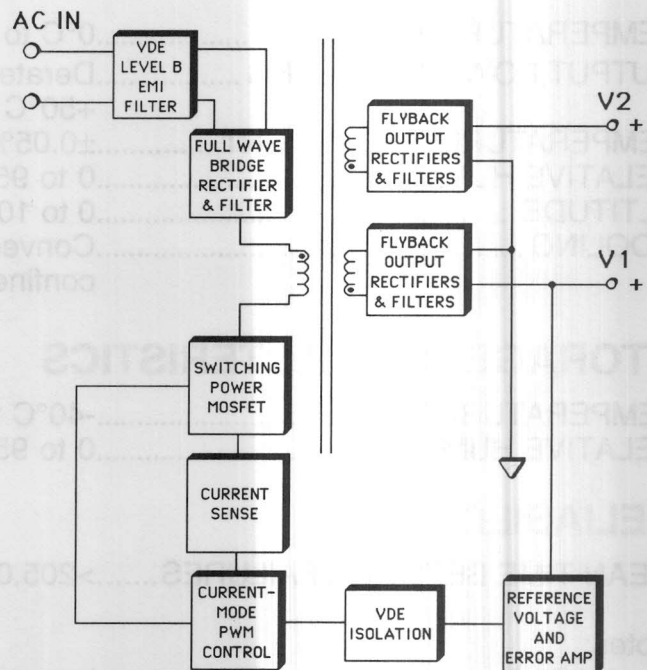
Four models provide dc output combinations of +5.0V and +12V, +15V, +24V or +28V. Standard features include 16-millisecond hold-up time, 5700 VDC input/output isolation and an on-board input line fuse. Other features include soft start, current limiting, indefinite short-circuit and over-voltage protection. The transient load capability of the outputs make the MDU2-40 an ideal choice for applications with pulsed loads, such as disk or tape drives and other electro-mechanical devices.

The MDU2-40 series is designed to achieve ultra-high reliability. MTBF is 205,000, minimum, calculated per the "parts stress" method specified by MIL-HDBK 217E. Operation is specified over the temperature range of 0° to +70°C with cooling by natural convection.

All models are fabricated on a compact 3.0 x 5.0-inch printed circuit board with a maximum component height of 1.5 inches.



FUNCTIONAL BLOCK DIAGRAM



MDU2-40 SERIES

GENERAL SPECIFICATIONS

AC INPUT	Universal input voltage range 85-265 VAC single phase or 100-370 VDC.
INPUT LINE FREQUENCY	47-63 Hz.
INPUT LINE PROTECTION	MOV. Input line fuse provided on-board. (See Note 1.)
EMI FILTER	Standard. Exceeds requirements of VDE/FCC Class B by 10 dB, typical.
DC OUTPUT	See voltage/current rating chart.
CONTINUOUS OUTPUT POWER	40 watts, maximum.
OUTPUT VOLTAGE ADJUST	Adjustable $\pm 5\%$, primary output only.
EFFICIENCY	65%, typical. Measured at full load and nominal input line.
HOLD-UP TIME	16 ms at 115 VAC, 40 ms at 220 VAC.
OVERLOAD PROTECTION	Power-limit circuit.
SHORT-CIRCUIT PROTECTION	Indefinite.
OVER-VOLTAGE PROTECTION	Primary output only.
SOFT START	Standard on all models. Prevents output overshoot and power transformer saturation at turn-on.
DESIGN TOPOLOGY	Flyback converter, current-mode control.
FREQUENCY OF OPERATION	40 kHz (fixed).
HI-POT ISOLATION	5700 VDC, input-to-output for one minute. (See Note 2.)
NOISE, RIPPLE and SPIKES	1% peak-to-peak, maximum. (See Note 3.)
TRANSIENT RESPONSE	4 ms recovery to within 1% of regulation band with 5% maximum deviation.

ENVIRONMENTAL OPERATING CHARACTERISTICS

TEMPERATURE RANGE	0°C to +70°C
OUTPUT POWER DERATING	Derate output power and current linearly 2%/°C from +50°C to +70°C.
TEMPERATURE COEFFICIENT	$\pm 0.05\%/^{\circ}\text{C}$ over the entire operating temperature range.
RELATIVE HUMIDITY	0 to 95%, non-condensing.
ALTITUDE	0 to 10,000 feet.
COOLING	Convection cooling is adequate. When operating in a confined area, moving air is recommended.

STORAGE CHARACTERISTICS

TEMPERATURE RANGE	-40°C to +85°C.
RELATIVE HUMIDITY	0 to 95%, non-condensing.

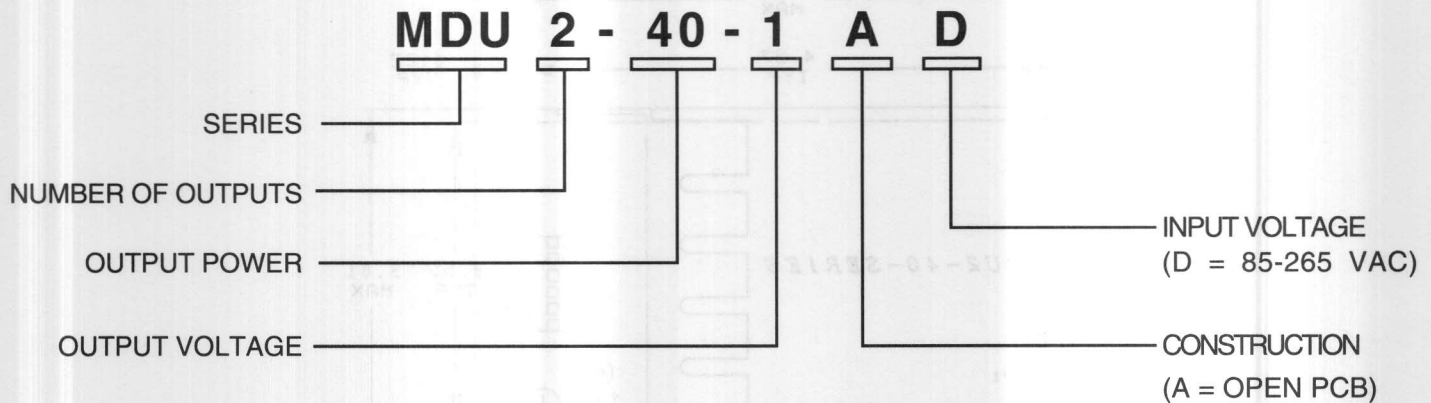
RELIABILITY

MEAN TIME BETWEEN FAILURES.....>205,000 hours. (See Note 4.)

Notes:

1. Replace input line fuse with the same type and rating. Recommended: **2.0A/250 VAC slow-blow** fuse.
2. Hi-Pot isolation is 2200 VDC between input and ground for one minute.
3. Peak-to-peak and RMS metering equipment shall have a 20 MHz response with probes and cables maintaining a frequency response of 20 Hz to 20 MHz. Output ripple and spikes are measured directly at the output terminals of the power supply across a 0.1 μF ceramic capacitor without use of the probe ground.
4. Per MIL-HDBK 217E Parts Stress Method. Assumes ground benign and $T_A = +25^{\circ}\text{C}$.

MODEL SELECTION GUIDE



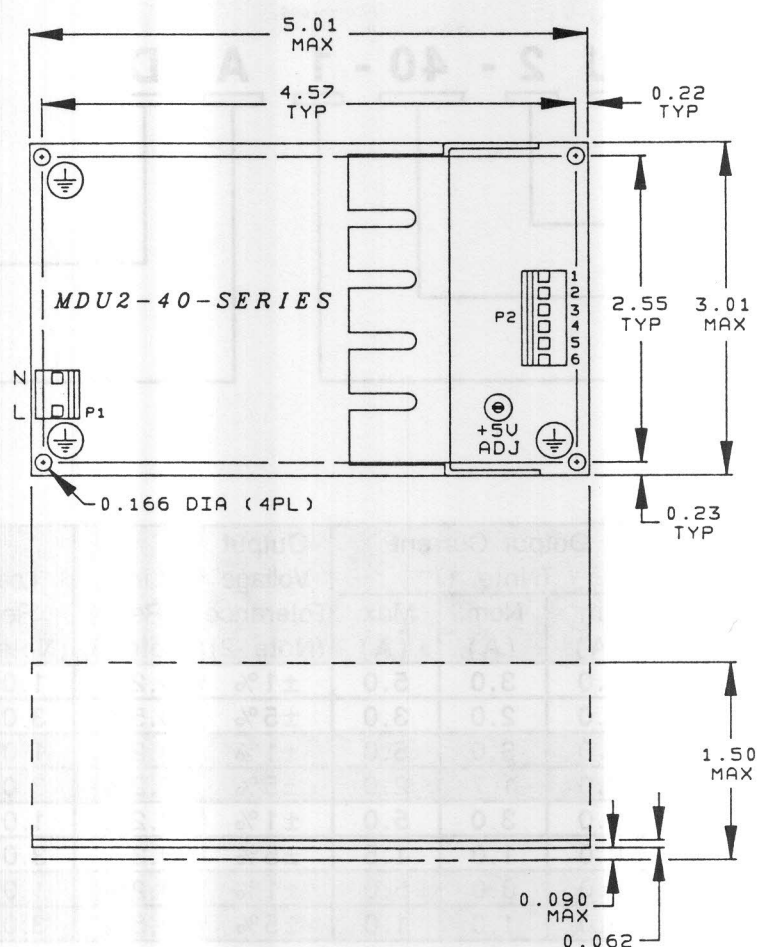
Model Number	Output Voltage		Output Current (Note 1)			Output Voltage Tolerance (Note 2)	Line Reg. (Note 3)	Load Reg. (Note 4)	Cross- Reg. (Note 5)	Max. Leakage Current (μ A)
			Min. (A)	Nom. (A)	Max. (A)					
MDU2-40-1	V1	+5.0	0.0	3.0	5.0	$\pm 1\%$	0.2%	1.0%	—	200
	V2	+12	0.0	2.0	3.0	$\pm 5\%$	0.5%	3.0%	4.0%	
MDU2-40-2	V1	+5.0	0.0	3.0	5.0	$\pm 1\%$	0.2%	1.0%	—	200
	V2	+15	0.0	1.7	2.0	$\pm 5\%$	0.2%	3.0%	4.0%	
MDU2-40-3	V1	+5.0	0.0	3.0	5.0	$\pm 1\%$	0.2%	1.0%	—	200
	V2	+24	0.0	1.0	1.5	$\pm 5\%$	0.2%	3.0%	4.0%	
MDU2-40-4	V1	+5.0	0.0	3.0	5.0	$\pm 1\%$	0.2%	1.0%	—	200
	V2	+28	0.0	1.0	1.0	$\pm 5\%$	0.5%	3.0%	4.0%	

Notes:

1. The sum of primary and auxiliary load currents must not exceed 5.0A.
2. Output tolerance is measured under nominal load conditions.
3. Line regulation is measured under nominal load conditions with the input voltage varied from 85 VAC to 265 VAC.
4. Load regulation is measured at 115 VAC or 230 VAC input, while the output being measured is loaded to 60% nominal load and varied +40%/-30%. The other output is nominally loaded.
5. Cross-regulation is measured by changing the load on the primary output (V1) from 50% to 100% of nominal load while measuring the voltage change on the auxiliary output.
6. All measurements should be made directly at the terminals of the power supply.
7. The MDU2-40 series is approved to UL544 (File E76127).

MDU2-40 SERIES

MECHANICAL OUTLINE AND PIN CONFIGURATION



Notes:

1. Dimensions shown are in inches.
2. Tolerances = 0.00 ±0.01
0.000 ±0.005

PIN-OUT

Pin	MDU2-40-1	MDU2-40-2	MDU2-40-3	MDU2-40-4
1	+12V/3.0A	+15V/2.0A	+24V/1.5A	+28V/1.0A
2	5.0V	5.0V	5.0V	5.0V
3	5.0A	5.0A	5.0A	5.0A
4	COMMON	COMMON	COMMON	COMMON
5				
6	N/C	N/C	N/C	N/C

CONNECTORS

P1 Input Connector		P2 Output Connector	
MOLEX 09-74-1031		MOLEX 09-74-1061	
Pin 1	Pin 2		
AC Neutral	AC Line		
MOLEX Mating Connector		MOLEX Mating Connector	
Housing	09-50-1031	Housing	09-50-1061
Crimp Terminal	08-70-1030	Crimp Terminal	08-70-1030

40W TRIPLE OUTPUT SWITCHING POWER SUPPLIES —UL544 APPROVED, UNIVERSAL INPUT RANGE—

FEATURES

- UL544 Medical Safety Approval
- IEC601/EN60-601 Safety Approval
- Universal Input Voltage Range
- 40 Watts Continuous Output Power
- 5700 VDC Input/Output Isolation
- VDE/FCC Class B Input Line Filter
- 0% Minimum Load on All Outputs
- Over-Current Protection
- Short-Circuit Protection
- 2-Year Warranty
- **Minimum 205,000 Hours MTBF**

APPLICATIONS

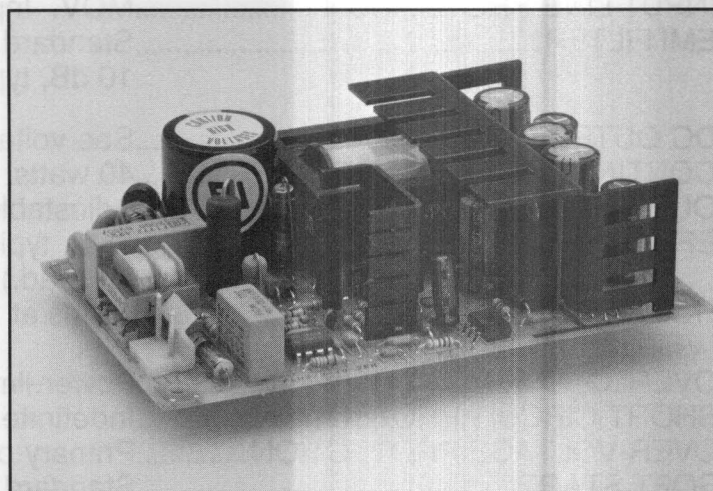
- Medical, Dental, Lab Equipment
- Industrial Systems and Instrumentation

MDU3-40 is a series of triple-output, 40-watt, open-frame switching power supplies with UL and IEC medical safety standards approval for *non-patient-contact* applications in which high isolation and low leakage currents are critical. The series offers 5700 VDC input/output isolation and high-performance features such as a universal input voltage range of 85 VAC to 265 VAC (or 100-370 VDC) and an on-board EMI suppression filter that complies to VDE/FCC Class B specifications.

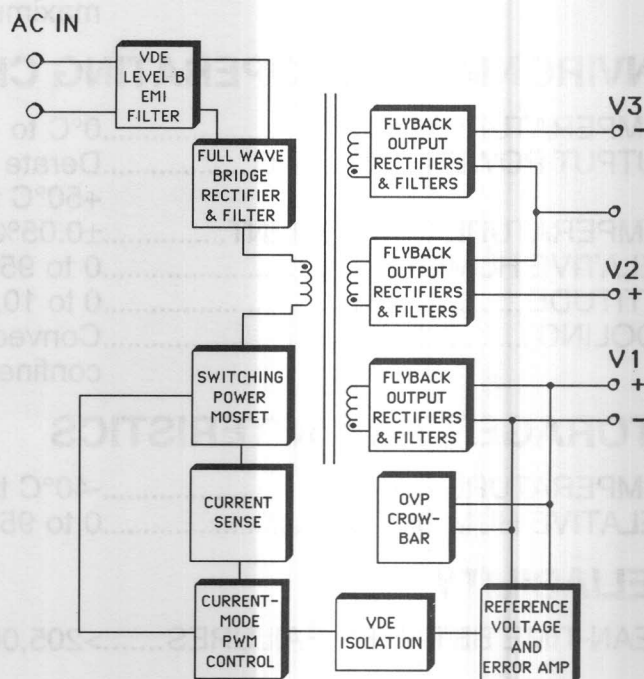
Four models provide dc outputs of +5.0V and combinations of $\pm 12V$, $\pm 15V$, +12V and -5.0V, or +24V and -12V. Standard features include 16-millisecond hold-up time and an on-board input line fuse. The series provides soft start, indefinite short-circuit protection, over-voltage protection and current limiting. Efficiency is typically 65 percent; primary load regulation is 1.0 percent; the primary output is adjustable ± 5 percent. The transient load capability of the +12V and +24V outputs make the MDU3-40 series an ideal choice for applications with pulsed loads such as disk/tape drives and other electro-mechanical devices.

The MDU3-40 series is designed for ultra-high reliability. The minimum MTBF (calculated per the "parts stress method of MIL-HDBK 217E) is 205,000 hours. Operation is specified over a 0°C to +70°C temperature range with cooling by natural convection.

All models are fabricated on a compact 3.0 x 5.0-inch printed circuit board with a maximum component height of 1.5 inches.



FUNCTIONAL BLOCK DIAGRAM



MDU3-40 SERIES

GENERAL SPECIFICATIONS

AC INPUT	Universal input voltage range, 85-265 VAC single phase or 100-370 VDC.
INPUT LINE FREQUENCY	47-63 Hz.
INPUT LINE PROTECTION	MOV. Input line fuse provided on-board. (See Note 1.)
EMI FILTER	Standard. Exceeds requirements of VDE/FCC Class B by 10 dB, typical.
DC OUTPUT	See voltage/current rating chart.
CONTINUOUS OUTPUT POWER	40 watts, maximum.
OUTPUT VOLTAGE ADJUST	Adjustable $\pm 5\%$, primary output only.
EFFICIENCY	65%, typical. (Nominal input voltage line conditions and full load.)
HOLD-UP TIME	16 ms at 115 VAC; 40 ms at 220 VAC.
OVERLOAD PROTECTION	Power-limit circuit.
SHORT-CIRCUIT PROTECTION	Indefinite.
OVER-VOLTAGE PROTECTION	Primary output only.
SOFT START	Standard on all models. Prevents output overshoot and power transformer saturation at turn-on.
DESIGN TOPOLOGY	Flyback converter, current-mode control.
FREQUENCY OF OPERATION	40 kHz (fixed).
HI-POT ISOLATION	5700 VDC, input-to-output for one minute. (See Note 2.)
NOISE, RIPPLE & SPIKES	1% peak-to-peak, maximum (See Note 3.)
TRANSIENT RESPONSE	4 ms recovery to within 1% of regulation band with 5% maximum deviation.

ENVIRONMENTAL OPERATING CHARACTERISTICS

TEMPERATURE RANGE	0°C to +70°C.
OUTPUT POWER DERATING	Derate output power and current linearly 2%/°C from +50°C to +70°C.
TEMPERATURE COEFFICIENT	$\pm 0.05\%/^{\circ}\text{C}$ over the entire operating temperature range.
RELATIVE HUMIDITY	0 to 95%, non-condensing.
ALTITUDE	0 to 10,000 feet.
COOLING	Convection cooling is adequate. When operating in a confined area, moving air is recommended.

STORAGE CHARACTERISTICS

TEMPERATURE RANGE	-40°C to +85°C.
RELATIVE HUMIDITY	0 to 95%, non-condensing.

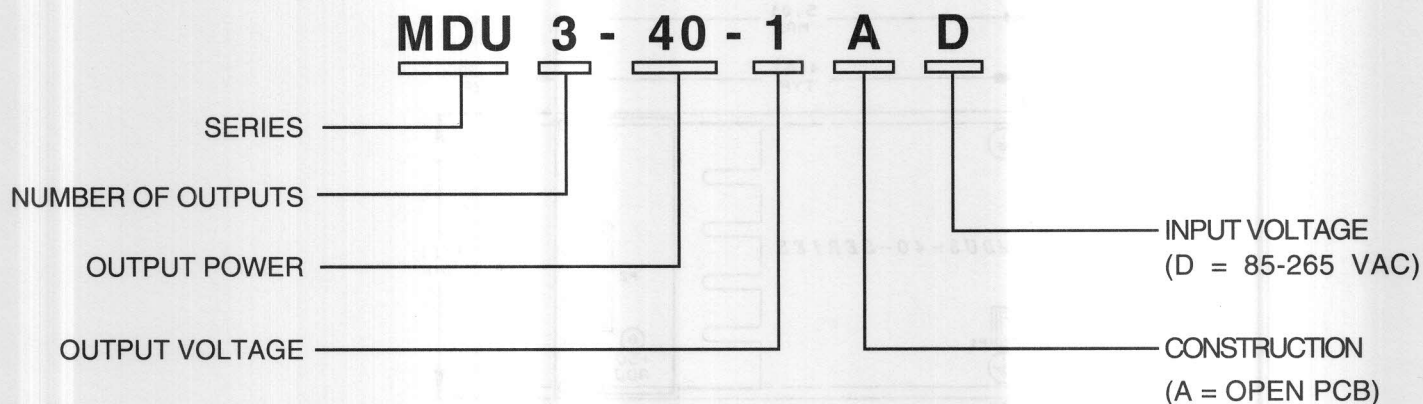
RELIABILITY

MEAN TIME BETWEEN FAILURES.....>205,000 hours. (See Note 4.)

Notes:

1. Replace input line fuse with the same type rating. Recommended **2.0A/250 VAC slow blow** fuse.
2. Hi-Pot isolation is 2200 VDC between input and ground for one minute.
3. Peak-to-peak and RMS metering equipment shall have a 20 MHz response with probes and cables maintaining frequency response from 20 Hz to 20 MHz. Output ripple and spikes are measured directly at the output terminals of the power supply across a 0.1 μF ceramic capacitor without use of the probe ground.
4. Per MIL-HDBK 217E Parts Stress Method. Assumes ground benign and $T_A = +25^{\circ}\text{C}$.

MODEL SELECTION GUIDE



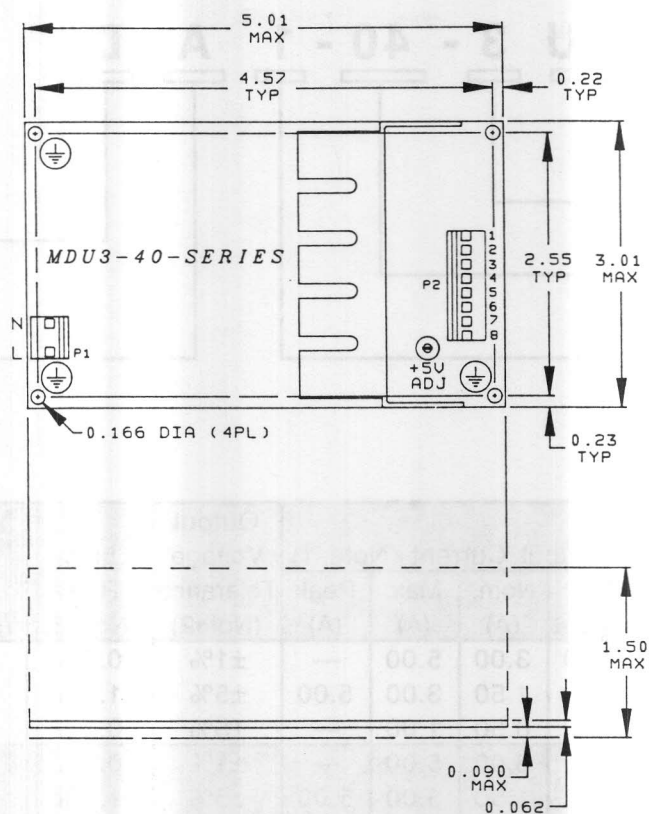
Model Number	Output Voltage		Output Current (Note 1)				Output Voltage Tolerance (Note2)	Line Reg. (Note 3)	Load Reg. (Note 4)	Cross- Reg. (Note 5)	Max. Leakage Current (μA)
			Min.	Nom.	Max.	Peak					
	Output	(V)	(A)	(A)	(A)	(A)					
MDU3-40-1	V1	+5.0	0.00	3.00	5.00	—	±1%	0.2%	1.0%	—	200
	V2	+12	0.00	1.50	3.00	5.00	±5%	1.0%	3.0%	4.0%	
	V3	-12	0.00	0.50	1.00	—	±5%	0.2%	1.0%	1.0%	
MDU3-40-2	V1	+5.0	0.00	3.00	5.00	—	±1%	0.2%	1.0%	—	200
	V2	+12	0.00	1.50	3.00	5.00	±5%	1.0%	3.0%	4.0%	
	V3	-5.0	0.00	1.00	1.00	—	±3%	0.2%	1.0%	1.0%	
MDU3-40-3	V1	+5.0	0.00	3.00	5.00	—	±1%	0.2%	1.0%	—	200
	V2	+15	0.00	1.20	2.00	3.00	±5%	1.0%	3.0%	4.0%	
	V3	-15	0.00	0.50	1.00	—	±5%	0.2%	1.0%	1.0%	
MDU3-40-4	V1	+5.0	0.00	3.00	5.00	—	±1%	0.2%	1.0%	—	200
	V2	+24	0.00	0.75	1.50	2.00	±5%	1.0%	3.0%	4.0%	
	V3	-12	0.00	0.50	1.00	—	±5%	0.2%	1.0%	1.0%	

Notes:

1. The sum of the +5.0 VDC and auxiliary (V2/V3) load currents must not exceed 5.0A .
2. Output voltage tolerance is measured under nominal load conditions.
3. Line regulation is measured under nominal load conditions with the input voltage varied from 85 to 265 VAC.
4. Load regulation is measured at 115 VAC or 230 VAC input, while the output being measured is loaded to 60% of nominal load and varied +40%/-30%. The other outputs are nominally loaded.
5. Cross-regulation is measured by changing the load on the primary output (V1) from 50% to 100% of nominal load while measuring the voltage change on an auxiliary output.
6. All measurements should be made directly at the terminals of the power supply.
7. The MDU3-40 series is approved to UL544 (File E76127).

MDU3-40 SERIES

MECHANICAL OUTLINE AND PIN CONFIGURATION



Notes:

1. Dimensions shown are in inches.
2. Tolerances = 0.00 ±0.01
0.000 ±0.005

PIN-OUT

Pin	MDU3-40-1	MDU3-40-2	MDU3-40-3	MDU3-40-4
1	+12V/3.0A	+12V/3.0A	+15V/2.0A	+24V/1.5A
2	+5.0	+5.0	+5.0	+5.0
3	5.0A	5.0A	5.0A	5.0A
4	COMMON	COMMON	COMMON	COMMON
5				
6	-12V/0.7A	-5.0V/1.0A	-15V/0.6A	-12V/0.7A
7	N/C	N/C	N/C	N/C
8				

CONNECTORS

P1 Input Connector

MOLEX 09-74-1031

Pin Function

1	AC Neutral
2	AC Line

MOLEX Mating Connector

Housing 09-50-1031

Crimp Terminal 08-70-1030

P2 Output Connector

MOLEX 09-74-1061

MOLEX Mating Connector

Housing 09-50-1061

Crimp Terminal 08-70-1030

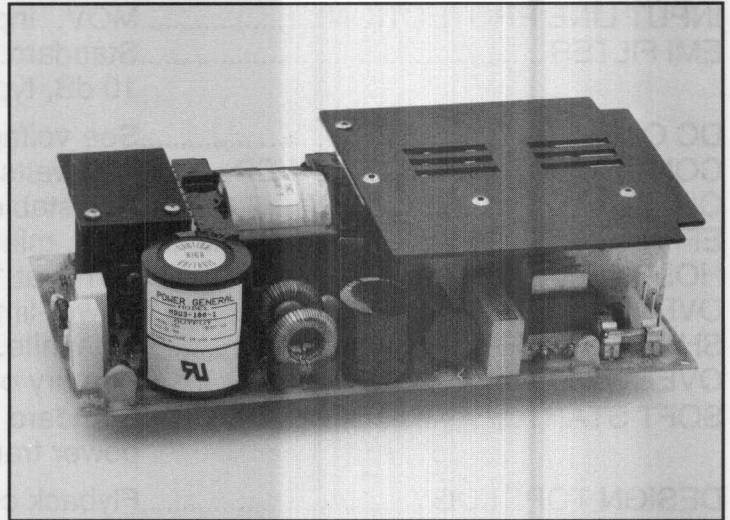
100W TRIPLE OUTPUT SWITCHING POWER SUPPLIES —UL544 MEDICAL SAFETY, UNIVERSAL INPUT RANGE—

FEATURES

- Meets UL544 Medical Safety Standard
- Meets IEC601/EN60-601 Standard
- 100 Watts Continuous Output Power
- 5700 VDC Input/Output Isolation
- 0% Minimum Load on All Outputs
- Over-Current Protection
- Short-Circuit Protection
- 2-Year Warranty
- **Minimum 165,000 Hours MTBF**

APPLICATIONS

- Medical and Dental Equipment
- Laboratory Equipment
- Industrial Systems and Instrumentation



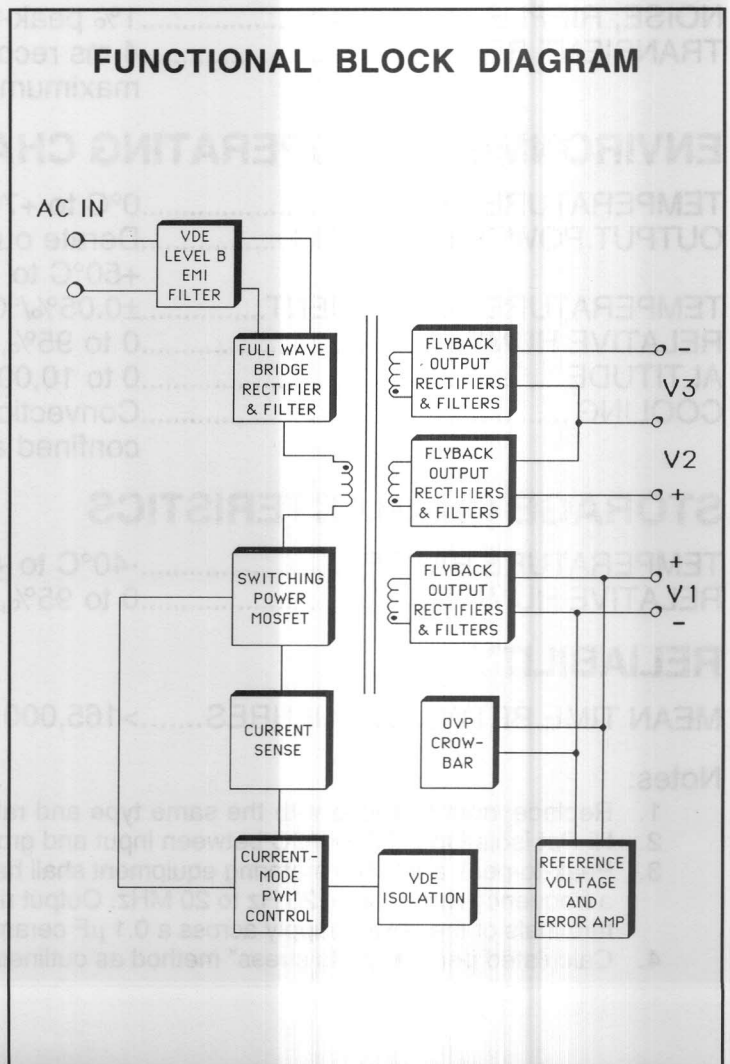
MDU3-100 is a series of three-output, 100-watt, open-frame switching power supplies designed to meet UL and IEC safety standards for *non-patient-contact* applications in medical, dental and lab equipment. The series offers 5700 VDC input/output isolation and high-performance features such as a universal input voltage range of 85 VAC to 265 VAC (or 100-370 VDC) and an on-board EMI filter that complies to VDE/FCC Class B specifications.

Four models provide dc output of +5.0V and combinations of +12V and -5.0V, $\pm 12V$, +24V and -5.0V, or +24V and -12V. Standard features include 16-millisecond hold-up time and an on-board input line fuse. The series provides current limiting, soft start, indefinite short-circuit protection and over-voltage protection. The series' efficiency rating is 65 percent, minimum; primary load regulation is 1.0 percent; the primary is adjustable ± 5 percent.

The MDU3-100 series is designed for ultra-high reliability. The minimum MTBF (calculated per the "parts stress" method outlined in MIL-HDBK 217E) is greater than 165,000 hours. Operation is specified over the temperature range of 0°C to +70°C with cooling by natural convection.

All models are fabricated on a compact, double-sided 4.0 x 8.0-inch printed circuit board with a maximum component height of 2.2 inches.

FUNCTIONAL BLOCK DIAGRAM



MDU3-100 SERIES

GENERAL SPECIFICATIONS

AC INPUT	Universal input voltage range, 85-265 VAC single phase, or 100-370 VDC.
INPUT LINE FREQUENCY	47-63 Hz.
INPUT LINE PROTECTION	MOV. Input line fuse provided on-board. (See Note 1.)
EMI FILTER	Standard. Exceeds requirements of VDE/FCC Class B by 10 dB, typical.
DC OUTPUT	See voltage/current rating chart.
CONTINUOUS OUTPUT POWER	100 watts, maximum.
OUTPUT VOLTAGE ADJUST	Adjustable $\pm 5\%$.
EFFICIENCY	65%, minimum.
HOLD-UP TIME	16 ms at 115 VAC; 40 ms at 230 VAC.
OVERLOAD PROTECTION	Power-limit circuit.
SHORT-CIRCUIT PROTECTION	Indefinite.
OVER-VOLTAGE PROTECTION	Primary output only, crowbar type, 120% V_{OUT} , typical.
SOFT START	Standard on all models. Prevents output overshoot and power transformer saturation at turn-on.
DESIGN TOPOLOGY	Flyback converter, current-mode control.
FREQUENCY OF OPERATION	25 kHz (fixed).
HI-POT ISOLATION	5700 VDC, input-to-output for one minute. (See Note 2.)
NOISE, RIPPLE and SPIKES	1% peak-to-peak, maximum. (See Note 3.)
TRANSIENT RESPONSE	4 ms recovery to within 1% of regulation band with 5% maximum deviation.

ENVIRONMENTAL OPERATING CHARACTERISTICS

TEMPERATURE RANGE	0°C to +70°C
OUTPUT POWER DERATING	Derate output power and current linearly 2%/°C from +50°C to +70°C.
TEMPERATURE COEFFICIENT	$\pm 0.05\%/^{\circ}\text{C}$ over the entire operating temperature range.
RELATIVE HUMIDITY	0 to 95%, non-condensing.
ALTITUDE	0 to 10,000 feet.
COOLING	Convection cooling is adequate. When operating in a confined area, moving air is recommended.

STORAGE CHARACTERISTICS

TEMPERATURE RANGE	-40°C to +85°C.
RELATIVE HUMIDITY	0 to 95%, non-condensing.

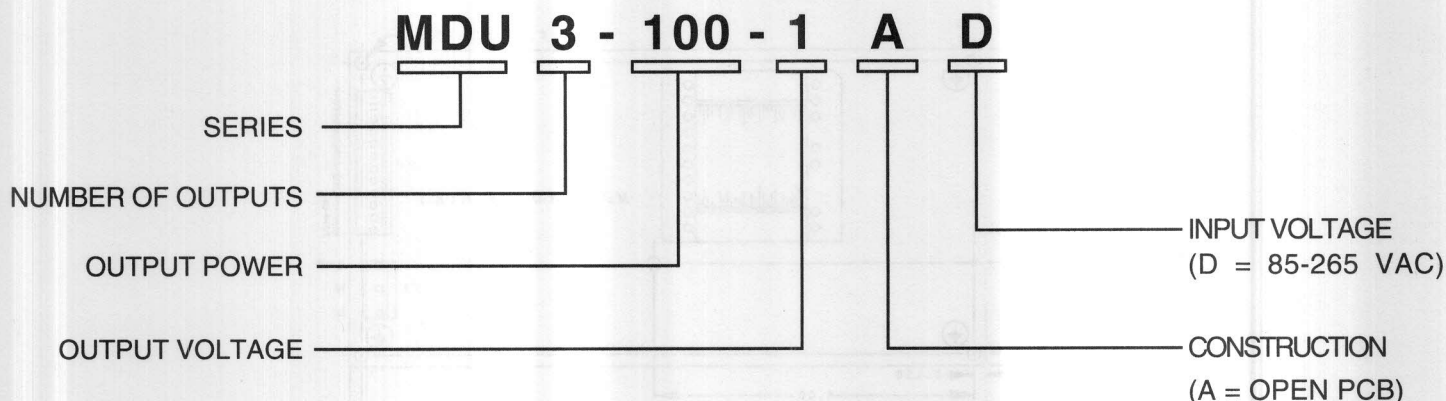
RELIABILITY

MEAN TIME BETWEEN FAILURES.....>165,000 hours. (See Note 4.)

Notes:

1. Replace input line fuse with the same type and rating. Recommended: **3.5A/250 VAC slow-blow** fuse.
2. Hi-Pot isolation is 2200 VDC between input and ground for one minute.
3. Peak-to-peak and RMS metering equipment shall have a 20 MHz response with probes and cables maintaining a frequency response of 20 Hz to 20 MHz. Output ripple and spikes are measured directly at the output terminals of the power supply across a 0.1 μF ceramic capacitor without use of the probe ground.
4. Calculated per the "parts stress" method as outlined in MIL-HDBK 217E. Assumes ground benign and +25°C.

MODEL SELECTION GUIDE



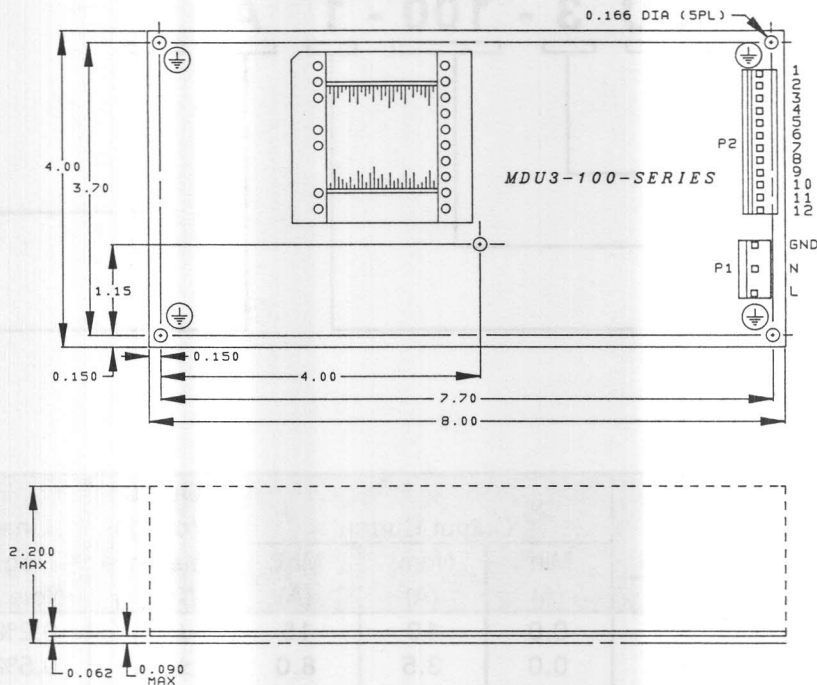
Model Number	Output Voltage		Output Current			Output Voltage Tolerance (Note1)	Line Reg. (Note 2)	Load Reg. (Note 3)	Cross-Reg. (Note 4)
			Min. (A)	Nom. (A)	Max. (A)				
	Output	(V)							
MDU3-100-1	V1	+5.0	0.0	10	15	±1%	0.2%	1.0%	—
	V2	+12	0.0	3.5	8.0	±5%	0.5%	3.0%	3.0%
	V3	-5.0	0.0	1.0	1.0	±5%	0.5%	1.0%	0.5%
MDU3-100-2	V1	+5.0	0.0	10	15	±1%	0.2%	1.0%	—
	V2	+12	0.0	3.0	8.0	±5%	0.5%	3.0%	3.0%
	V3	-12	0.0	1.0	1.0	±5%	0.5%	1.0%	0.5%
MDU3-100-3	V1	+5.0	0.0	10	15	±1%	0.2%	1.0%	—
	V2	+24	0.0	1.8	4.0	±5%	1.0%	3.0%	3.0%
	V3	-5.0	0.0	1.0	1.0	±5%	0.2%	1.0%	0.5%
MDU3-100-4	V1	+5.0	0.0	10	15	±1%	0.2%	1.0%	—
	V2	+24	0.0	1.5	4.0	±5%	1.0%	3.0%	3.0%
	V3	-12	0.0	1.0	1.0	±5%	0.2%	1.0%	0.5%

Notes:

1. Output voltage tolerance is measured under nominal load conditions.
2. Line regulation is measured under nominal load conditions with the input voltage varied from 85 to 265 VAC.
3. Load regulation is measured at 115 VAC or 230 VAC input. The output being measured is brought to 60 percent of nominal load; that load current is then varied +40 percent/-30 percent of nominal load. The other output is held at nominal load conditions.
4. Cross-regulation is tested by changing the load on the primary output from 50 percent to 100 percent of nominal load while measuring the voltage change on the auxiliary output.
5. All measurements should be made directly at the terminals of the power supply.

MDU3-100 SERIES

MECHANICAL OUTLINE AND PIN CONFIGURATION



Notes:

1. Dimensions shown are in inches.
2. Tolerances = 0.00 ± 0.01
0.000 ± 0.005

PIN-OUT

Pin	MDU3-100-1	MDU3-100-2	MDU3-100-3	MDU3-100-4
1	COMMON	COMMON	COMMON	COMMON
2				
3				
4	+5.0V/15A	+5.0V/15A	+5.0V/15A	+5.0V/15A
5				
6				
7	COMMON	COMMON	COMMON	COMMON
8	+12V/8.0A	+12V/8.0A	+24V/4.0A	+24V/4.0A
9				
10				
11	COMMON	COMMON	COMMON	COMMON
12	N/A	N/A	N/A	N/A

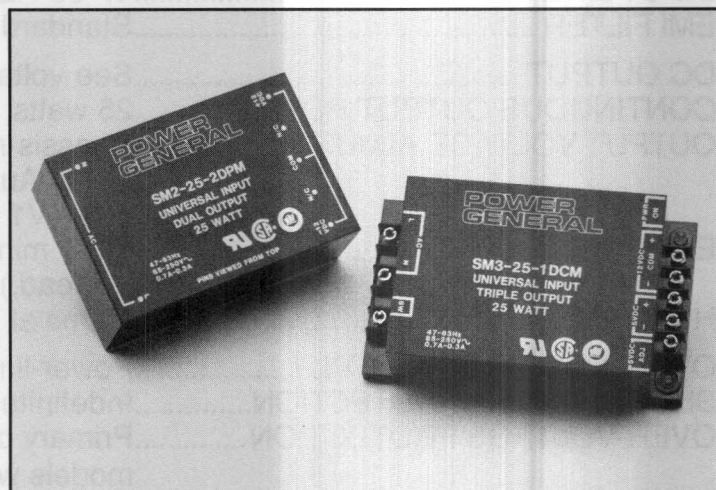
CONNECTORS

P1 Input Connector Models 1 through 4: MOLEX 09-74-1051		P2 Output Connector MOLEX 09-74-1121	
Pin	Function		
1	AC Line		
2	AC Neutral		
3	Ground		
MOLEX Mating Connector:		MOLEX Mating Connector	
Housing	09-50-1051	Housing	09-50-1121
Crimp Terminal	08-70-1030	Crimp Terminal	08-70-1030

25W ENCAPSULATED SWITCHING POWER SUPPLIES —SINGLE, DUAL OR TRIPLE OUTPUT—

FEATURES

- 85-265 VAC Input Voltage Range
- 25 Watts Continuous Output Power
- UL1950 Approved
- CSA C22.2-220 Approved
- Meets VDE0805
- TUV/EN60950/IEC950 Approved
- FCC Class A Input Line Filter
- PC- or Chassis-Mount Package
- 0% Minimum Load Requirement
- Over-Current/Short-Circuit Protection
- Minimum 165,000 hours MTBF
- **2-Year Warranty**



APPLICATIONS

- Microprocessor-Based Systems
- Analog/Digital Systems
- General-Purpose Power Supply

SM1/2/3-25 is a series of one-, two- or three-output, 25-watt, modular switching power supplies. Approved to international safety agency standards, the supplies offer flexibly useful combinations of performance, reliability and packaging.

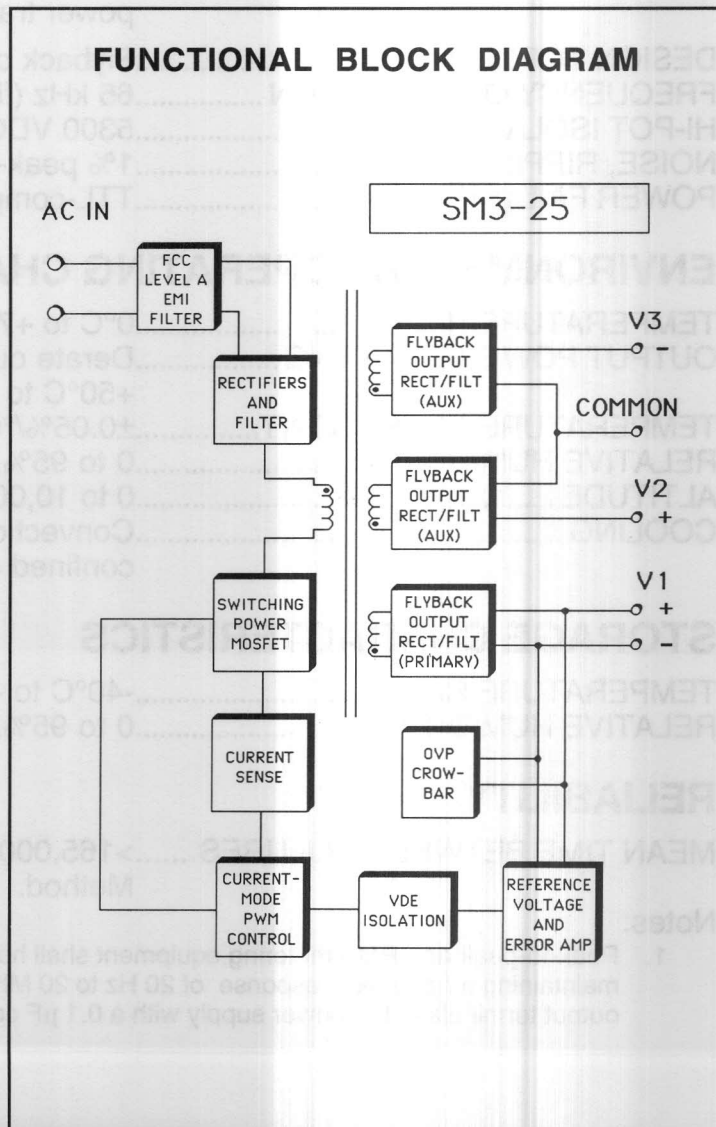
High-performance features include a universal input voltage range of 85 VAC to 265 VAC (or 118-370 VDC), 16-millisecond hold-up time, 5300 VDC input/output isolation and tight line/load regulation. Soft start, over-voltage protection of the primary output, a built-in EMI filter that complies to FCC Class A specifications and indefinite short-circuit protection are standard on all models.

Single-output chassis-mount models have remote sensing compensation for improved load regulation and an optional power-fail warning function.

The SM1/2/3-25 series is designed for ultra-high reliability. The minimum MTBF (calculated per the "parts stress" method of MIL-HDBK 217E) is 165,000 hours. Operation is specified over a temperature range of 0°C to +70°C with natural-convection cooling.

PC-mount dimensions are 2.5 x 3.5 x 1.4 inches for single-output models, and 2.75 x 4.1 x 1.4 inches for dual-output and triple-output models. The chassis-mount models are 2.8 x 4.7 x 1.4 inches.

FUNCTIONAL BLOCK DIAGRAM



SM1/2/3-25 SERIES

GENERAL SPECIFICATIONS

AC INPUT	85-265 VAC, single phase, or 118-370 VDC.
INPUT LINE FREQUENCY	47-63 Hz.
EMI FILTER	Standard. Meets requirements of FCC Class A.
DC OUTPUT	See voltage/current rating chart.
CONTINUOUS OUTPUT POWER	25 watts, maximum.
OUTPUT VOLTAGE ADJUST	Chassis-mount models only: Primary output adjustable $\pm 3\%$. Auxiliary outputs fixed, $\pm 4\%$. Dual output, adjustable $\pm 3\%$ (V1 and V2 move together).
EFFICIENCY	60%, minimum. (Nominal input voltage line conditions and full load.)
HOLD-UP TIME	16 ms at 115 VAC, 80 ms at 220 VAC.
OVERLOAD PROTECTION	Power-limit circuit.
SHORT-CIRCUIT PROTECTION	Indefinite.
OVER-VOLTAGE PROTECTION	Primary output (V1), 120% V_{OUT} , typical. For dual output models with $\pm 12V$ or $\pm 15V$ outputs, 120% of $2V_1$ or $-2V_2$, typical.
SOFT START	Standard on all models. Prevents output overshoot and power transformer saturation at turn-on.
DESIGN TOPOLOGY	Flyback converter, current-mode control.
FREQUENCY OF OPERATION	65 kHz (fixed).
HI-POT ISOLATION	5300 VDC, input-to-output for one minute.
NOISE, RIPPLE & SPIKES	1% peak-to-peak, maximum. (See Note 1.)
POWER FAIL (OPTIONAL)	TTL-compatible (chassis-mount, single-output 5.0V model).

ENVIRONMENTAL OPERATING CHARACTERISTICS

TEMPERATURE RANGE	0°C to +70°C.
OUTPUT POWER DERATING	Derate output power and current linearly 2%/°C from +50°C to +70°C.
TEMPERATURE COEFFICIENT	$\pm 0.05\%/^{\circ}\text{C}$ over the entire operating temperature range.
RELATIVE HUMIDITY	0 to 95%, non-condensing.
ALTITUDE	0 to 10,000 feet.
COOLING	Convection cooling is adequate. When operating in a confined area, moving air is recommended.

STORAGE CHARACTERISTICS

TEMPERATURE RANGE	-40°C to +85°C.
RELATIVE HUMIDITY	0 to 95%, non-condensing.

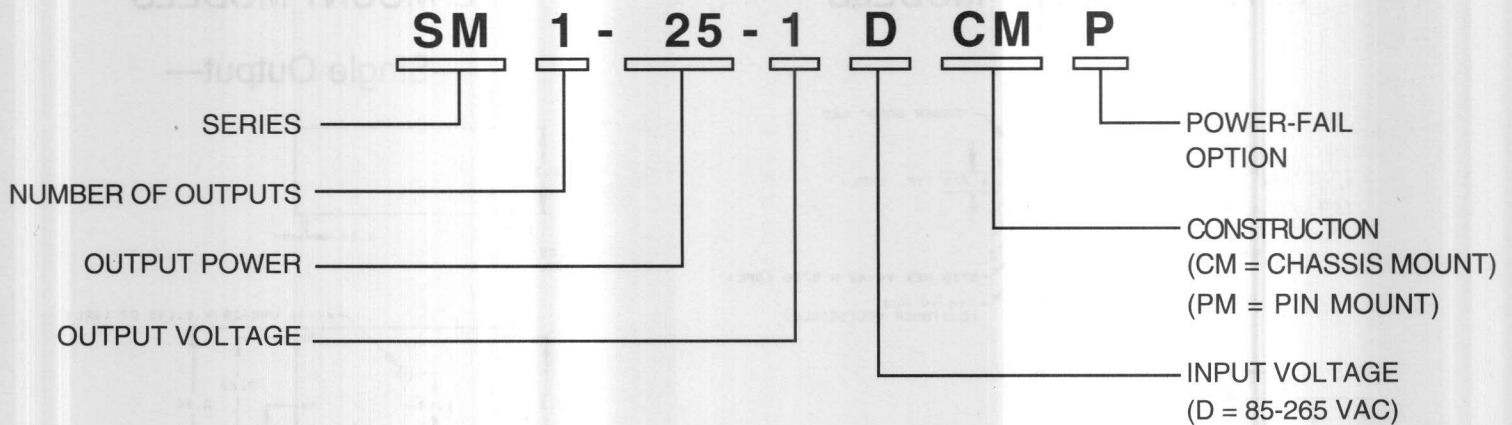
RELIABILITY

MEAN TIME BETWEEN FAILURES	>165,000 Hours, per MIL-HDBK 217E Parts Stress Method. (Ground benign, +25°C.)
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Notes:

1. Peak-to-peak and RMS metering equipment shall have a 20 MHz frequency response with probes and cables maintaining a frequency response of 20 Hz to 20 MHz. Output ripple and spikes are measured directly at the output terminals of the power supply with a 0.1 μF ceramic capacitor without the use of the probe ground clip.

MODEL SELECTION GUIDE



Model Number	Output Voltage		Output Current			Output Voltage Tolerance (Note 1)	Line Reg. (Note 2)	Load Regulation (Notes 3, 4, 5)		Cross-Reg. (Note 6)
			Min. (A)	Nom. (A)	Max. (A)			CM	PM	
	Output	(V)								
SM1-25-1	V1	+5.0	0.00	5.00	5.00	1.0%	0.1%	0.1%	0.4%	—
SM1-25-2	V1	+9.0	0.00	2.80	2.80	1.0%	0.1%	0.1%	0.4%	—
SM1-25-3	V1	+12	0.00	2.10	2.10	1.0%	0.1%	0.1%	0.4%	—
SM1-25-4	V1	+15	0.00	1.70	1.70	1.0%	0.1%	0.1%	0.4%	—
SM1-25-5	V1	+24	0.00	1.00	1.05	1.0%	0.1%	0.1%	0.4%	—
SM1-25-6	V1	+28	0.00	0.90	0.90	1.0%	0.1%	0.1%	0.4%	—
SM2-25-1	V1	+5.0	0.00	4.00	4.00	1.0%	0.1%	0.5%	0.5%	—
	V2	-5.0	0.00	1.00	1.60	4.0%	0.1%	0.3%	0.3%	0.3%
SM2-25-2	V1	+12	0.00	1.00	1.80	2.0%	0.5%	2.0%	2.0%	2.0%
	V2	-12	0.00	1.00	1.80	2.0%	0.5%	2.0%	2.0%	2.0%
SM2-25-3	V1	+15	0.00	0.80	1.60	2.0%	0.5%	2.0%	2.0%	2.0%
	V2	-15	0.00	0.80	1.60	2.0%	0.5%	2.0%	2.0%	2.0%
SM3-25-1	V1	+5.0	0.00	4.00	4.00	1.0%	0.1%	0.5%	0.5%	—
	V2	+12	0.00	0.20	0.30	4.0%	0.1%	0.3%	0.3%	0.1%
	V3	-12	0.00	0.20	0.30	4.0%	0.1%	0.3%	0.3%	0.1%
SM3-25-2	V1	+5.0	0.00	3.80	4.00	1.0%	0.1%	0.5%	0.5%	—
	V2	+15	0.00	0.20	0.30	4.0%	0.1%	0.3%	0.3%	0.1%
	V3	-15	0.00	0.20	0.30	4.0%	0.1%	0.3%	0.3%	0.1%

Notes:

- Output voltage tolerance is measured at nominal load conditions.
- Line regulation is measured under nominal load conditions with the input voltage varied from 85 to 265 VAC.
- Load regulation is measured at 115 VAC or 230 VAC input while the output under test is loaded to 60% of nominal load and varied $\pm 40\%$ of nominal load. Other outputs are held at nominal load.
- Remote sensing links are provided for chassis-mount, single-output models for improved load regulation.
- Derate output power by 1% for each 1% of remote sensing compensation or output voltage adjustment.
- Cross-regulation is tested by changing the load on the primary output (V1) from 50% to 100% of nominal load while measuring the voltage change on the auxiliary output.
- All measurements should be made directly at the terminals of the power supply.
- The SM1/2/3 series is approved to UL1950 (File No. E76127), CSA 22.2-220 (File No. LR52335), and EN60950/VDE0805/IEC950 (TUV License No. 97573).

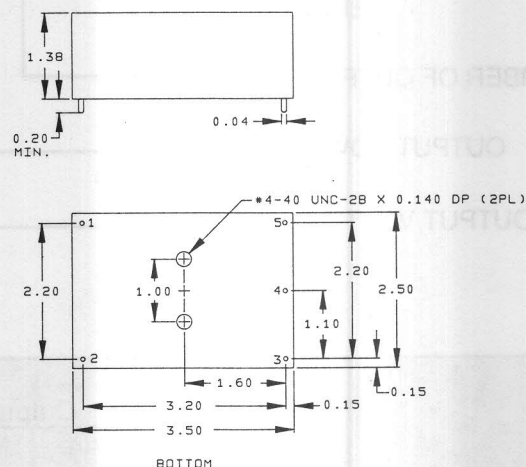
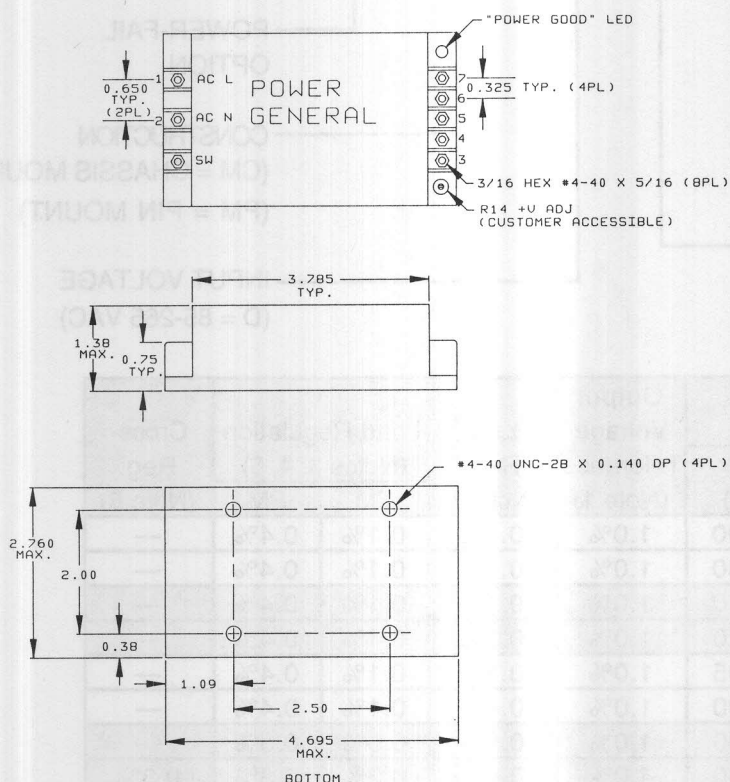
SM1/2/3-25 SERIES

MECHANICAL OUTLINE AND PIN CONFIGURATION

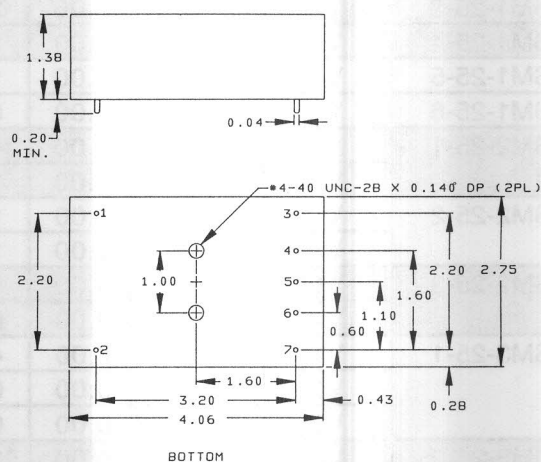
CHASSIS-MOUNT MODELS

PC-MOUNT MODELS

—Single Output—



—Dual and Triple Output—



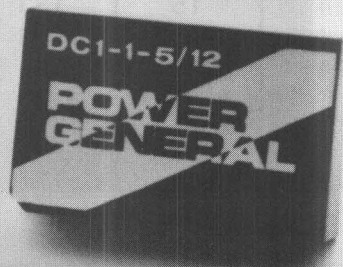
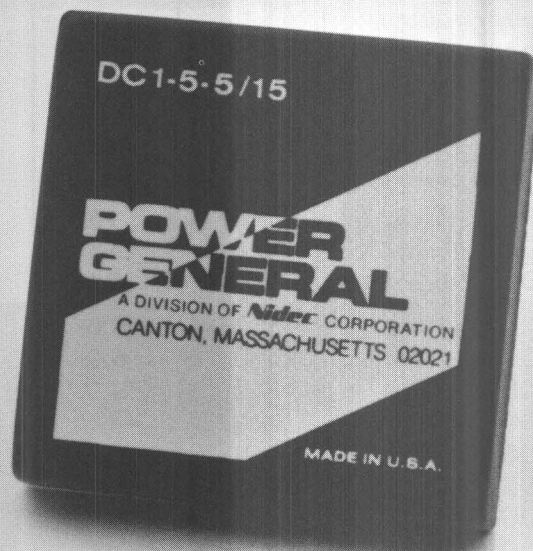
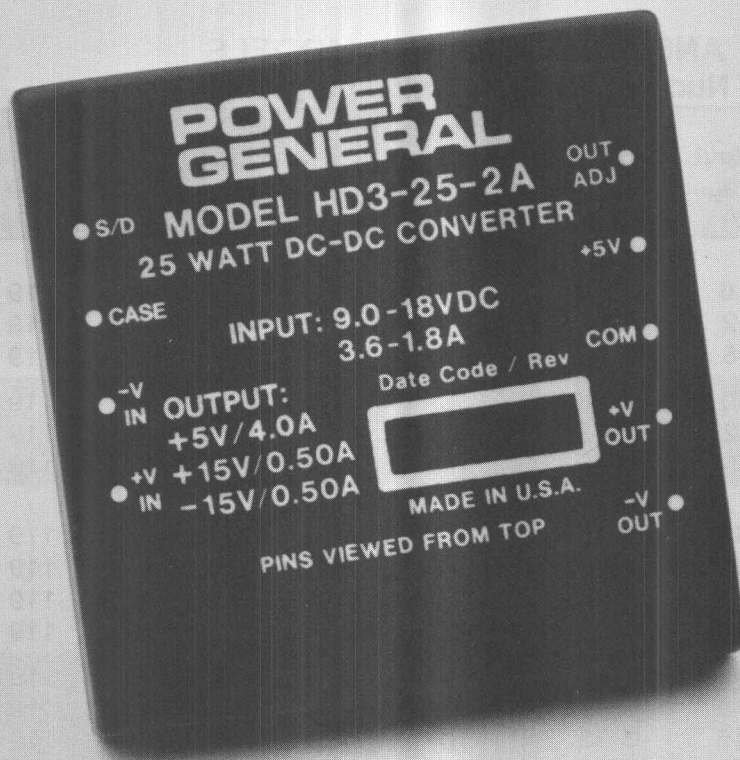
Notes:

1. Dimensions shown are in inches.
2. Tolerances = 0.00 ±0.01 inch.
0.000 ±0.005 inch
3. Terminal "SW" on chassis-mount models is for ac line connection through an external switch: No internal connection.

PIN-OUT

Pin	Chassis-Mount Models			PC-Mount Models		
	SM1-25	SM2-25	SM3-25	SM1-25	SM2-25	SM3-25
1	AC LINE	AC LINE	AC LINE	AC LINE	AC LINE	AC LINE
2	AC NEUTRAL	AC NEUTRAL	AC NEUTRAL	AC NEUTRAL	AC NEUTRAL	AC NEUTRAL
3	- SENSE	N/C	+5.0V RTN	+ V OUT	- V OUT	- V OUT
4	RETURN	+ V OUT	+5.0V	RETURN	N/C	+5.0V RTN
5	+ V OUT	COMMON	- V OUT	N/C	COMMON	COMMON
6	+ SENSE	COMMON	COMMON	—	N/C	+5.0V
7	POWER-FAIL	- V OUT	+ V OUT	—	+ V OUT	+ V OUT

DC-DC CONVERTERS



QUICK SELECTION GUIDE

—DC-DC Converters—

ENCAPSULATED SINGLE AND DUAL OUTPUT MODELS

In Order of Output Power, Number of Outputs, Input Voltage

Model Number	Input Voltage (V)	Output Voltage (V)	Max. Output Current (mA)	Max. Output Power (W)	Package Size (Inches)	For Complete Data, See Page
<i>1W Singles</i>						
DC1-1-5/5	5.0	5.0	100	0.5	0.8 x 1.25 x 0.4	119
DC1-1-5/12	5.0	12	80	1.0	0.8 x 1.25 x 0.4	119
DC1-1-5/15	5.0	15	65	1.0	0.8 x 1.25 x 0.4	119
DC1-1-12/5	12	5.0	100	0.5	0.8 x 1.25 x 0.4	119
DC1-1-12/12	12	12	80	1.0	0.8 x 1.25 x 0.4	119
DC1-1-12/15	12	15	65	1.0	0.8 x 1.25 x 0.4	119
<i>1W Duals</i>						
DC2-1-5/12	5.0	±12	40	1.0	0.8 x 1.25 x 0.4	119
DC2-1-5/12A	5.0	±12	40	1.0	0.8 x 1.25 x 0.4	119
DC2-1-5/15	5.0	±15	33	1.0	0.8 x 1.25 x 0.4	119
DC2-1-5/15A	5.0	±15	33	1.0	0.8 x 1.25 x 0.4	119
DC2-1-12/12A	12	±12	40	1.0	0.8 x 1.25 x 0.4	119
DC2-1-12/12	12	±12	40	1.0	0.8 x 1.25 x 0.4	119
DC2-1-12/15	12	±15	33	1.0	0.8 x 1.25 x 0.4	119
DC2-1-12/15A	12	±15	33	1.0	0.8 x 1.25 x 0.4	119
<i>2W Singles</i>						
DC1-2-5/5	5.0	5.0	400	2.0	1.0 x 2.0 x 0.38	121
DC1-2-5/5A	5.0	5.0	400	2.0	1.0 x 2.0 x 0.38	121
DC1-2-5/9A	5.0	9.0	222	2.0	1.0 x 2.0 x 0.38	121
DC1-2-5/12	5.0	12	167	2.0	1.0 x 2.0 x 0.38	121
DC1-2-5/12A	5.0	12	167	2.0	1.0 x 2.0 x 0.38	121
DC1-2-5/15	5.0	15	133	2.0	1.0 x 2.0 x 0.38	121
DC1-2-5/15A	5.0	15	133	2.0	1.0 x 2.0 x 0.38	121
DC1-2-5/24A	5.0	24	83	2.0	1.0 x 2.0 x 0.38	121
DC1-2-12/5	12	5.0	400	2.0	1.0 x 2.0 x 0.38	121
DC1-2-12/5A	12	5.0	400	2.0	1.0 x 2.0 x 0.38	121
DC1-2-12/9A	12	9.0	222	2.0	1.0 x 2.0 x 0.38	121
DC1-2-12/12	12	12	167	2.0	1.0 x 2.0 x 0.38	121
DC1-2-12/12A	12	12	167	2.0	1.0 x 2.0 x 0.38	121
DC1-2-12/15	12	15	133	2.0	1.0 x 2.0 x 0.38	121
DC1-2-12/15A	12	15	133	2.0	1.0 x 2.0 x 0.38	121
DC1-2-12/24A	12	24	83	2.0	1.0 x 2.0 x 0.38	121
DC1-2-24/5	24	5.0	400	2.0	1.0 x 2.0 x 0.38	121
DC1-2-24/5A	24	5.0	400	2.0	1.0 x 2.0 x 0.38	121
DC1-2-24/9A	24	9.0	222	2.0	1.0 x 2.0 x 0.38	121
DC1-2-24/12	24	12	167	2.0	1.0 x 2.0 x 0.38	121
DC1-2-24/12A	24	12	167	2.0	1.0 x 2.0 x 0.38	121
DC1-2-24/15	24	15	133	2.0	1.0 x 2.0 x 0.38	121
DC1-2-24/15A	24	15	133	2.0	1.0 x 2.0 x 0.38	121
DC1-2-24/24A	24	24	83	2.0	1.0 x 2.0 x 0.38	121
DC1-2-28/5A	28	5.0	400	2.0	1.0 x 2.0 x 0.38	121
DC1-2-28/9A	28	9.0	222	2.0	1.0 x 2.0 x 0.38	121
DC1-2-28/12A	28	12	167	2.0	1.0 x 2.0 x 0.38	121
DC1-2-28/15A	28	15	133	2.0	1.0 x 2.0 x 0.38	121
DC1-2-28/24A	28	24	83	2.0	1.0 x 2.0 x 0.38	121

QUICK SELECTION GUIDE

—DC-DC Converters—

ENCAPSULATED SINGLE AND DUAL OUTPUT MODELS

In Order of Output Power, Number of Outputs, Input Voltage

Model Number	Input Voltage (V)	Output Voltage (V)	Max. Output Current (mA)	Max. Output Power (W)	Package Size (Inches)	For Complete Data, See Page
<i>2W Singles (Continued)</i>						
DC1-2-48/5	28	5.0	400	2.0	1.0 x 2.0 x 0.38	121
DC1-2-48/5A	28	5.0	400	2.0	1.0 x 2.0 x 0.38	121
DC1-2-48/9A	28	9.0	222	2.0	1.0 x 2.0 x 0.38	121
DC1-2-48/12A	28	12	167	2.0	1.0 x 2.0 x 0.38	121
DC1-2-48/15A	28	15	133	2.0	1.0 x 2.0 x 0.38	121
DC1-2-48/24A	28	24	83	2.0	1.0 x 2.0 x 0.38	121
<i>2W Duals</i>						
DC2-2-5/12	5.0	±12	83	2.0	1.0 x 2.0 x 0.38	121
DC2-2-5/15	5.0	±15	65	2.0	1.0 x 2.0 x 0.38	121
DC2-2-12/12	12	±12	83	2.0	1.0 x 2.0 x 0.38	121
DC2-2-12/15	12	±15	65	2.0	1.0 x 2.0 x 0.38	121
DC2-2-24/12	24	±12	83	2.0	1.0 x 2.0 x 0.38	121
DC2-2-24/15	24	±15	65	2.0	1.0 x 2.0 x 0.38	121
DC2-2-28/12	28	±12	83	2.0	1.0 x 2.0 x 0.38	121
DC2-2-28/15	28	±15	65	2.0	1.0 x 2.0 x 0.38	121
DC2-2-48/12	48	±12	83	2.0	1.0 x 2.0 x 0.38	121
DC2-2-48/15	48	±15	65	2.0	1.0 x 2.0 x 0.38	121
<i>5W Singles</i>						
DC1-5-5/5	5.0	5.0	1000	5.0	2.0 x 2.0 x 0.38	124
DC1-5-5/9	5.0	9.0	600	5.4	2.0 x 2.0 x 0.38	124
DC1-5-5/12	5.0	12	500	6.0	2.0 x 2.0 x 0.38	124
DC1-5-5/15	5.0	15	400	6.0	2.0 x 2.0 x 0.38	124
DCU1-5-WR/5	7.0—32	5.0	1000	5.0	2.0 x 2.0 x 0.38	127
DC1-5-12/5	12	5.0	1000	5.0	2.0 x 2.0 x 0.38	124
DC1-5-12/9	12	9.0	600	5.4	2.0 x 2.0 x 0.38	124
DC1-5-12/12	12	12	500	6.0	2.0 x 2.0 x 0.38	124
DC1-5-12/15	12	15	400	6.0	2.0 x 2.0 x 0.38	124
DCU1-5-WR/12	14—32	12	600	7.2	2.0 x 2.0 x 0.38	127
DCU1-5-WR/15	17—32	15	500	7.5	2.0 x 2.0 x 0.38	127
DC1-5-24/5	24	5.0	1000	5.0	2.0 x 2.0 x 0.38	124
DC1-5-24/9	24	9.0	600	5.4	2.0 x 2.0 x 0.38	124
DC1-5-24/12	24	12	500	6.0	2.0 x 2.0 x 0.38	124
DC1-5-24/15	24	15	400	6.0	2.0 x 2.0 x 0.38	124
DC1-5-28/5	28	5	1000	5.0	2.0 x 2.0 x 0.38	124
DC1-5-28/9	28	9	600	5.4	2.0 x 2.0 x 0.38	124
DC1-5-28/12	28	12	500	6.0	2.0 x 2.0 x 0.38	124
DC1-5-28/15	28	15	400	6.0	2.0 x 2.0 x 0.38	124
DC1-5-48/5	48	5	1000	5.0	2.0 x 2.0 x 0.38	124
DC1-5-48/9	48	9	600	5.4	2.0 x 2.0 x 0.38	124
DC1-5-48/12	48	12	500	6.0	2.0 x 2.0 x 0.38	124
DC1-5-48/15	48	15	400	6.0	2.0 x 2.0 x 0.38	124

QUICK SELECTION GUIDE

—DC-DC Converters—

ENCAPSULATED SINGLE AND DUAL OUTPUT MODELS

In Order of Output Power, Number of Outputs, Input Voltage

Model Number	Input Voltage (V)	Output Voltage (V)	Max. Output Current (A)	Max. Output Power (W)	Package Size (Inches)	For Complete Data, See Page
<i>5W Duals</i>						
DC2-5-5/12	5.0	±12	0.25	6.0	2.0 x 2.0 x 0.38	124
DC2-5-5/15	5.0	±15	0.20	6.0	2.0 x 2.0 x 0.38	124
DC2-5-12/12	12	±12	0.25	6.0	2.0 x 2.0 x 0.38	124
DC2-5-12/15	12	±15	0.20	6.0	2.0 x 2.0 x 0.38	124
DC2-5-24/12	24	±12	0.25	6.0	2.0 x 2.0 x 0.38	124
DC2-5-24/15	24	±15	0.20	6.0	2.0 x 2.0 x 0.38	124
DC2-5-28/12	28	±12	0.25	6.0	2.0 x 2.0 x 0.38	124
DC2-5-28/15	28	±15	0.20	6.0	2.0 x 2.0 x 0.38	124
DC2-5-48/12	48	±12	0.25	6.0	2.0 x 2.0 x 0.38	124
DC2-5-48/15	48	±15	0.20	6.0	2.0 x 2.0 x 0.38	124
<i>6W Duals</i>						
DC2-6-5/12	5.0	±12	0.25	6.0	2.0 x 2.0 x 0.38	129
DC2-6-5/15	5.0	±15	0.20	6.0	2.0 x 2.0 x 0.38	129
DC2-6-5/18	5.0	±18	0.167	6.0	2.0 x 2.0 x 0.38	129
<i>15W Singles</i>						
HD1-15-5A	9.0—18	5.0	3.0	15	2.0 x 2.0 x 0.4	142
HD1-15-12A	9.0—18	12	1.25	15	2.0 x 2.0 x 0.4	142
HD1-15-15A	9.0—18	15	1.0	15	2.0 x 2.0 x 0.4	142
HD1-15-5B	18—36	5.0	3.0	15	2.0 x 2.0 x 0.4	142
HD1-15-12B	18—36	12	1.25	15	2.0 x 2.0 x 0.4	142
HD1-15-15B	18—36	15	1.0	15	2.0 x 2.0 x 0.4	142
HD1-15-5C	36—72	5.0	3.0	15	2.0 x 2.0 x 0.4	142
HD1-15-12C	36—72	12	1.25	15	2.0 x 2.0 x 0.4	142
HD1-15-15C	36—72	15	1.0	15	2.0 x 2.0 x 0.4	142
<i>24-33W Singles</i>						
HDU1-35-5-2/3.3	5.0	2.0—3.3	12—10	24—33	2.0 x 2.0 x 0.825	147
<i>40W Singles</i>						
HD1-40-5C	20—60	5.0	8.0	40	3.0 x 3.0 x 0.88	148
HD1-40-12C	20—60	12	3.5	40	3.0 x 3.0 x 0.88	148
HD1-40-15C	20—60	15	3.0	40	3.0 x 3.0 x 0.88	148

ENCAPSULATED 25W TRIPLE OUTPUT MODELS

In Order of Input Voltage, Secondary Output

Model Number	Input Voltage (V)	Output 1		Output 2		Output 3		Max. Output Power (W)	Package Size (Inches)	Full Data, See Page
		Output Voltage (V)	Max. Current (A)	Output Voltage (V)	Max. Current (A)	Output Voltage (V)	Max. Current (A)			
HD3-25-1A	9.0—18	5.0	5.00	+12	0.50	-12	0.50	25	3.0 x 3.0 x 0.5	144
HD3-25-2A	9.0—18	5.0	5.00	+15	0.50	-15	0.50	25	3.0 x 3.0 x 0.5	144
HD3-25-1B	18—36	5.0	5.00	+12	0.50	-12	0.50	25	3.0 x 3.0 x 0.5	144
HD3-25-2B	18—36	5.0	5.00	+15	0.50	-15	0.50	25	3.0 x 3.0 x 0.5	144
HD3-25-1C	36—72	5.0	5.00	+12	0.50	-12	0.50	25	3.0 x 3.0 x 0.5	144
HD3-25-2C	36—72	5.0	5.00	+15	0.50	-15	0.50	25	3.0 x 3.0 x 0.5	144

QUICK SELECTION GUIDE

—DC-DC Converters—

OPEN-FRAME MODELS

In Order of Output Power, Input Voltage

Model Number	Input Voltage (V)	Output 1		Output 2		Output 3		Output 4		Max. Output Power (W)	Full Data, See Page
		Output Voltage (V)	Max. Current (A)	Output Voltage (V)	Max. Current (A)	Output Voltage (V)	Max. Current (A)	Output Voltage (V)	Max. Current (A)		
50W Triples											
DC50-1A	10—18	5.0	6.0	12	1.0	12	1.0	—	—	50	131
DC50-2A	10—18	5.0	6.0	15	1.0	15	1.0	—	—	50	131
DC50-3A	10—18	5.0	6.0	12	3.0	12	0.5	—	—	50	131
DC50-4A	10—18	5.0	6.0	15	3.0	5.0	1.0	—	—	50	131
DC50-1B	18—36	5.0	6.0	12	1.0	12	1.0	—	—	50	131
DC50-2B	18—36	5.0	6.0	15	1.0	15	1.0	—	—	50	131
DC50-3B	18—36	5.0	6.0	12	3.0	12	0.5	—	—	50	131
DC50-4B	18—36	5.0	6.0	15	3.0	5.0	1.0	—	—	50	131
DC50-1C	36—72	5.0	6.0	12	1.0	12	1.0	—	—	50	131
DC50-2C	36—72	5.0	6.0	15	1.0	15	1.0	—	—	50	131
DC50-3C	36—72	5.0	6.0	12	3.0	12	0.5	—	—	50	131
DC50-4C	36—72	5.0	6.0	15	3.0	5.0	1.0	—	—	50	131
50-72W Singles											
DC60-1A	10—18	5.0	10	—	—	—	—	—	—	50	134
DC60-2A	10—18	12	5.0	—	—	—	—	—	—	60	134
DC60-3A	10—18	15	4.0	—	—	—	—	—	—	60	134
DC60-4A	10—18	24	2.5	—	—	—	—	—	—	60	134
DC60-1B	18—36	5.0	12	—	—	—	—	—	—	60	134
DC60-2B	18—36	12	6.0	—	—	—	—	—	—	72	134
DC60-3B	18—36	15	4.8	—	—	—	—	—	—	72	134
DC60-4B	18—36	24	3.0	—	—	—	—	—	—	72	134
DC60-1C	36—72	5.0	12	—	—	—	—	—	—	60	134
DC60-2C	36—72	12	6.0	—	—	—	—	—	—	72	134
DC60-3C	36—72	15	4.8	—	—	—	—	—	—	72	134
DC60-4C	36—72	24	3.0	—	—	—	—	—	—	72	134
85-100W Triples											
DC100-1A	10.5—18	5.0	12	12	5.0	12	1.0	—	—	85	136
DC100-2A	10.5—18	5.0	12	24	3.0	24	1.0	—	—	85	136
DC100-1B	18—36	5.0	12	12	5.0	12	1.0	—	—	100	136
DC100-2B	18—36	5.0	12	24	3.0	24	1.0	—	—	100	136
DC100-1C	36—72	5.0	12	12	5.0	12	1.0	—	—	100	136
DC100-2C	36—72	5.0	12	24	3.0	24	1.0	—	—	100	136
150W Quads											
DC4-150-1	38—64	5.0	15	12	4.0	12	4.0	5.0	4.0	150	138
DC4-150-2	38—64	5.0	15	12	4.0	12	4.0	12	6.0	150	138
DC4-150-3	38—64	5.0	15	12	4.0	12	4.0	15	4.0	150	138
DC4-150-4	38—64	5.0	15	12	4.0	12	4.0	24	3.0	150	138
DC4-150-5	38—64	5.0	15	15	3.0	15	3.0	5.0	4.0	150	138

THEORY OF OPERATION — DC-DC Converters

A dc-dc converter is a small switching power supply that contains a dc-ac inverter, the output of which is rectified and filtered to provide required dc output(s). Depending on requirements of the application, one of three basic design configurations is used: Self-oscillating push-pull (Figure 1), switching regulator (Figure 2), or forward switching converter (Figure 3).

PUSH-PULL CONVERTER

In the classical Royer or push-pull converter shown in Figure 1, the small, saturating transformer and the push-pull switching transistors, Q_1 and Q_2 compose a self-oscillating circuit that typically operates at a fixed frequency rate between 8 and 45 kHz.

When the dc input voltage is first applied, uneven leakage currents cause one transistor to turn ON. The transistor saturates, due to positive feedback on its base provided by the transformer. With one transistor on, the magnetizing flux in the transformer core steadily increases until the core saturates. This produces a voltage of opposite polarity across the transformer windings, turning the first transistor OFF and turning the second ON.

The switching action of the transistors chops the input voltage, generating an alternating, high-frequency,

square wave across the transformer secondary. This output is rectified and filtered to produce a dc voltage that is then series-pass regulated to generate the desired dc output voltage.

Push-pull dc-dc converters have become very popular for low power, local (on-card) power distribution systems. The various voltage levels required to power A/D and D/A converters, operational amplifiers, signal transducers and related circuitry are derived from a common power bus.

Push-pull converters exhibit efficiencies as high as 70 percent at full load and have input voltage ranges as high as ± 16 percent. Typical nominal input voltages are 5.0, 12, 24, 28, and 48 VDC with a combination of well-regulated, isolated outputs of 5.0, 9.0, 12, 15, ± 12 , ± 15 , ± 18 , ± 24 , or ± 28 VDC.

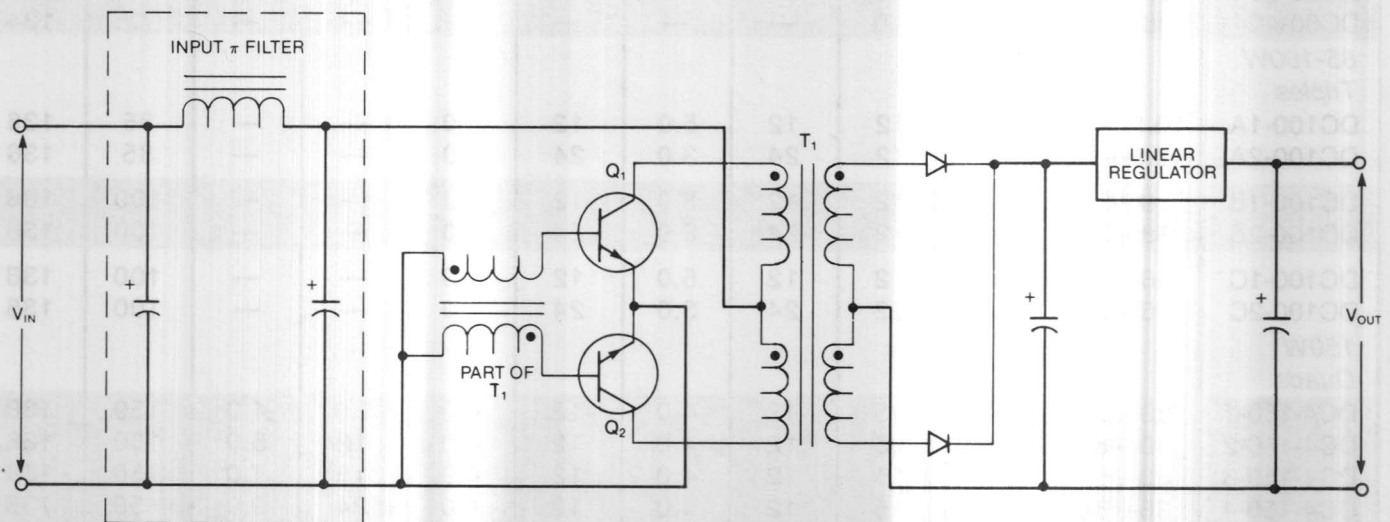


Figure 1: Push-Pull DC-DC Converter

3-TERMINAL SWITCHING DC-DC CONVERTER

Figure 2 shows a three-terminal (buck regulator) switching dc-dc converter. This circuit is very similar to a forward converter switching power supply with the elimination of the forward converter's off-line rectifier circuit and output isolation transformer.

Pulse-width modulation (PWM) is used to control the ON/OFF time of series switching transistor Q_1 . The square wave output of Q_1 is filtered by a dual LC output filter to produce the desired non-isolated output voltage. The dc output is series switched-mode regulated.

Switching converters are available with efficiencies as high as 89 percent. They are capable of higher output power and wider input voltage ranges than that achievable with a push-pull converter.

Figure 2: 3-Terminal Switching DC-DC Converter

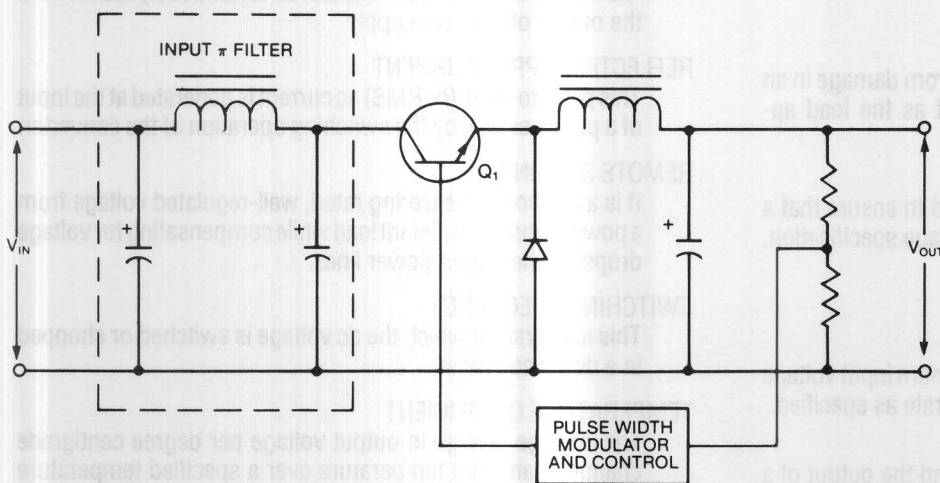
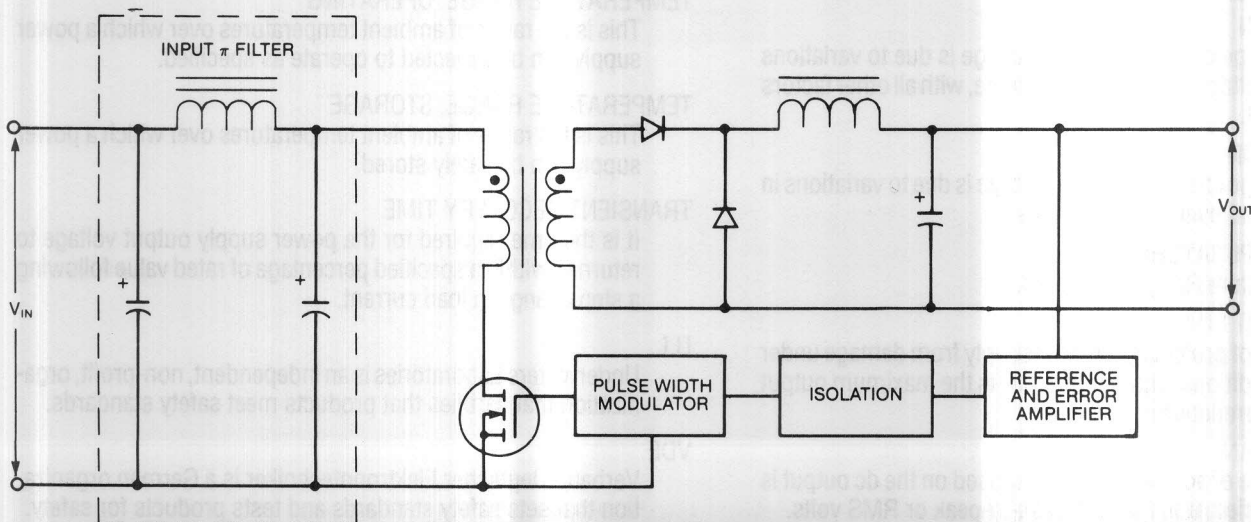


Figure 3: Forward Conversion, Switching DC-DC Converter



FORWARD CONVERSION SWITCHING DC-DC CONVERTER

The dc-dc converters used in applications involving battery systems require a wide input voltage range with high efficiency. One way to achieve this is to use the forward conversion circuit shown in Figure 3.

When the MOSFET switch is ON, voltage is applied to the transformer secondary and energy is stored in the output inductor. When the switch turns OFF, the output inductor cannot change value instantaneously, so current continues to flow in the output. The circuit uses a MOSFET switch to enable operation at higher switching frequencies.

This configuration allows input ranges as high as 5:1 with efficiencies approaching 90 percent. A typical nominal input voltage is 48V, with an acceptable range of 20V to 72V. Output is typically isolated, well-regulated combinations of 5.0, 9.0, 12, 15, 24 or 28VDC.

GLOSSARY — DC-DC Converter Terms

AMBIENT TEMPERATURE

The temperature of the still air immediately surrounding an operating power supply is the ambient temperature.

BREAKDOWN VOLTAGE

The maximum ac or dc voltage that can be applied between input and output terminals of a power supply without causing damage. Typical breakdown voltages for dc-dc converters are 300 VDC and 500 VDC, minimum.

C.S.A.

The Canadian Standards Association is an independent organization for establishment of safety standards and testing for compliance to safety standards.

CROWBAR

See Over-Voltage Protection.

CURRENT LIMITING

See Output Current Limiting.

EFFICIENCY

This ratio of output load power to input power, expressed as a percentage, is normally evaluated at full rated output power and nominal line conditions.

FAULT MODE CURRENT

Input current drawn by a power supply with the output short-circuited, is fault-mode current.

FOLD-BACK CURRENT LIMITING

This method of protecting a power supply from damage in an overload condition reduces output current as the load approaches short-circuit.

HI-POT TEST

A high-potential or high-voltage test is used to ensure that a supply passes its minimum breakdown voltage specification.

INPUT REFLECTED RIPPLE CURRENT

See Reflected Ripple Current.

INPUT VOLTAGE RANGE

The range is defined by minimum and maximum input voltage limits within which a power supply will operate as specified.

ISOLATION

The electrical isolation between the input and the output of a power supply, given in values of voltage and/or capacitance, is normally determined by the transformer characteristics and circuit spacing.

LINE REGULATION

This percentage change in output voltage is due to variations in the input voltage over a specified range, with all other factors held constant.

LOAD REGULATION

The percentage change in output voltage is due to variations in the output load over specified limits.

OPERATING TEMPERATURE RANGE

See Temperature Range, Operating.

OUTPUT CURRENT LIMITING

This method of protecting a power supply from damage under overload conditions automatically limits the maximum output current to a predetermined value.

OUTPUT RIPPLE AND NOISE

The amplitude of ac voltage superimposed on the dc output is usually specified at full load in peak-to-peak or RMS volts.

OUTPUT VOLTAGE

The regulated dc voltage is measured at the output terminals of a power supply.

OUTPUT VOLTAGE TOLERANCE (ACCURACY)

It is the maximum specified deviation of the dc output voltage from its rated value.

OVERSHOOT/UNDERSHOOT

This transient output voltage, beyond the specified accuracy limits, is generally caused by power supply start-up or shut-down or a step change in line or load.

OVER-VOLTAGE PROTECTION (OVP)

This safeguard is implemented by a device or circuit that crowbars or shuts down the power supply output if the output voltage exceeds a preset level.

PARD

Periodic and random deviations: See Output Ripple and Noise.

PI FILTER

This input filter, consisting of two parallel capacitors and a series inductance, is used to reduce reflected ripple current.

RATED OUTPUT CURRENT

It is the maximum current that can be continuously drawn from the output of a power supply

REFLECTED RIPPLE CURRENT

This peak-to-peak (or RMS) ac current is generated at the input of a power supply by the switching operation of the converter.

REMOTE SENSING

It is a method of delivering rated, well-regulated voltage from a power supply to a distant load while compensating for voltage drops on the output power lines.

SWITCHING FREQUENCY

This is the rate at which the dc voltage is switched or chopped in a dc-dc converter.

TEMPERATURE COEFFICIENT

The average change in output voltage per degree centigrade change in ambient temperature over a specified temperature range: It is usually expressed as percentage of rated output voltage per degree centigrade.

TEMPERATURE RANGE, OPERATING

This is the range of ambient temperatures over which a power supply can be expected to operate as specified.

TEMPERATURE RANGE, STORAGE

This is the range of ambient temperatures over which a power supply can be safely stored.

TRANSIENT RECOVERY TIME

It is the time required for the power supply output voltage to return to within a specified percentage of rated value following a step change in load current.

U.L.

Underwriters Laboratories is an independent, non-profit, organization that certifies that products meet safety standards.

VDE

Verband Deutscher Elektrotechniker is a German organization that sets safety standards and tests products for safety.

APPLICATION NOTES — DC-DC Converters

FUSING

The dc/dc converter input line should always be fused in order to ensure maximum protection and safety. Contact the manufacturer for the proper fuse rating or consult the appropriate data sheet specifications.

Models are available as encapsulated or open-frame

types. Encapsulated models, in general, do not have an internal fuse. An external fuse should be provided.

As a rule, use a fuse with 150 percent to 200 percent of the dc input current to the supply at full rated load. Use of normal or slow-blow fuses should be verified with the manufacturer.

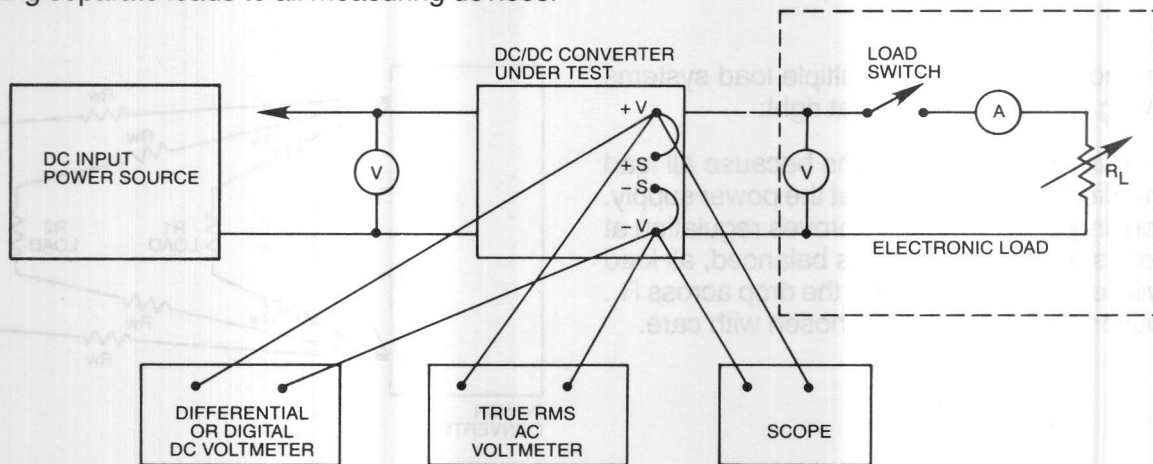
MEASUREMENT TECHNIQUES

All performance measurements for a constant-voltage dc/dc converter should be made directly at the converter terminals.

Pre-Measurement Conditions:

- Measure performance at the front or rear terminals.
- Connect all test instruments to the converter terminals using separate leads to all measuring devices.

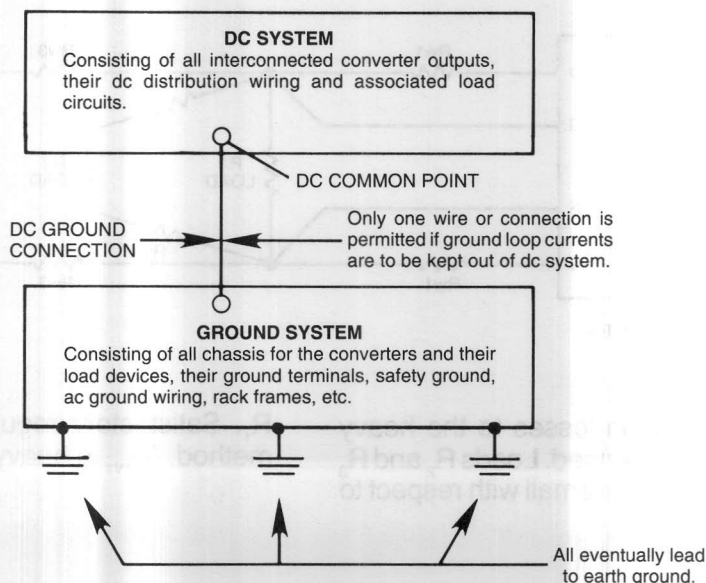
- Terminate test leads with solder or spade-type lugs.
- Use an adequate load resistor.
- Check current-limit control set point.
- Connect the input dc power source and monitor.
- After connecting the test system, check for system-generated noise and ripple.



GROUND CONNECTIONS

One aspect often overlooked when designing a power distribution system is system grounding. Ground connections should avoid ground loop problems. Ideally, there should be only one ground return point in a power

distribution system; however, complexity of the load and the dc wiring harness often forces compromises with the ideal grounding concept.

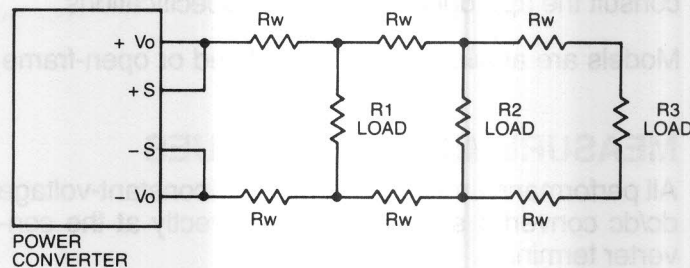


APPLICATION NOTES — DC-DC Converters

LOAD CONNECTIONS WITH A SINGLE SUPPLY

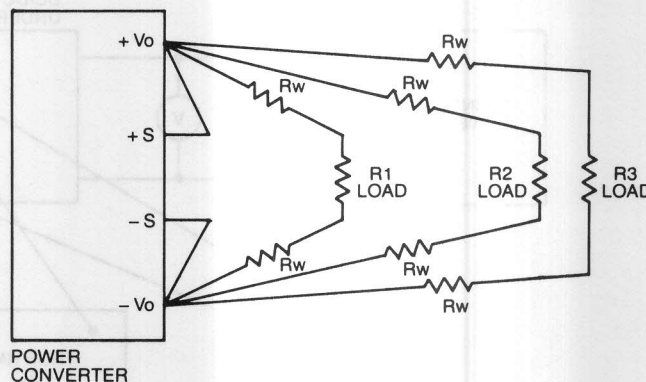
The simplest and most common example of improper load wiring is shown at right.

In this case, the voltage at each load is dependent on the current drawn by other loads. Poor regulation occurs due to voltage drops across wires. In some cases, the interaction of the loads can be ignored, but in most applications the resulting noise, pulse coupling, or tendency toward inter-load oscillation is undesirable and unacceptable. Problems caused by ground loops may arise if analog and digital circuits are connected together. A low-level analog signal should not share a conduction path with digital signals or power returns.

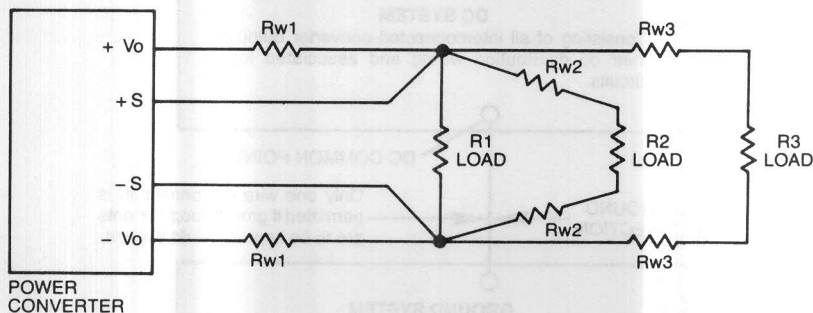


A better method of connecting multiple load systems and improving circuit operation is at right:

There are no interaction regulations because all load circuitry are effectively terminated at the power supply. Remote sensing at the R_1 load improves regulation at R_1 . If the loads are equal and R_w is balanced, all load voltages will be virtually identical to the drop across R_1 . The distribution wiring should be chosen with care.



As an alternate approach, the circuit below can be used.

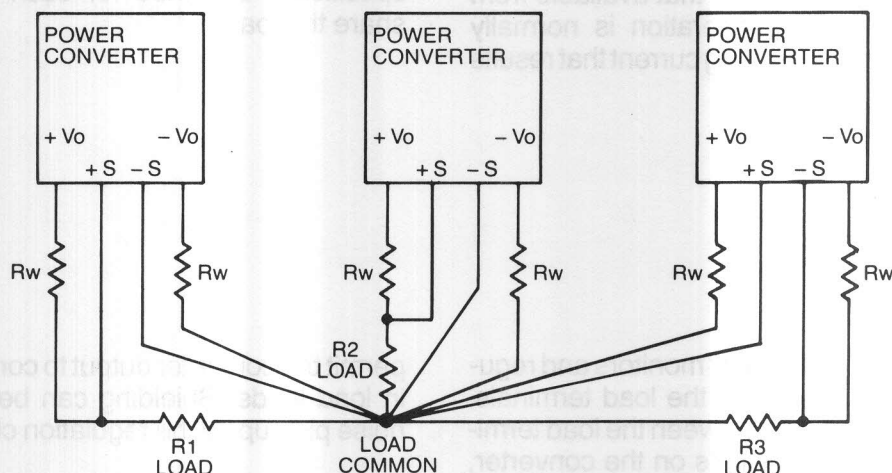


Here R_{w1} disperses distribution losses to the heavy load, R_1 . This load is remotely sensed. Loads R_2 and R_3 are tied to the same point, but are small with respect to

R_1 . Satisfactory regulation can be achieved by this method. (R_{w1} is heavy gauge wire.)

LOAD CONNECTIONS WITH MULTIPLE SUPPLIES

The following is the recommended method of connection.



Both remote and local sensing can be used, depending on the regulation required and the loads. The chassis ground connections should be made at one point.

A local decoupling capacitor, if required, can be connected across each pair of load and distribution terminals. This reduces the high-frequency impedance seen by any individual load looking back toward the converter and reduces high-frequency mutual coupling effects between loads fed from the same converter.

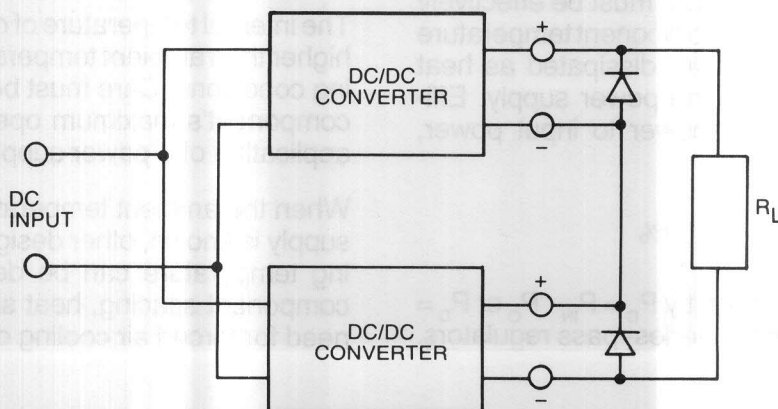
As a minimum, each load wire must be of sufficient size to carry the converter output current that would flow if associated load terminals are short-circuited.

During normal operating conditions some component temperatures may exceed the rating of wiring types commonly used in applications. It is recommended that all wiring in end-product applications be routed and tied away from contact with the converter.

SERIES OPERATION

In general, dc-dc converters can be operated with their outputs connected in series to obtain higher output voltages. Direct series coupling is generally permissible; however, the manufacturer should be consulted since the feedback loop of one converter could affect

the operation of another converter. The total output voltage should not exceed the working voltage of output components. External diodes have been added for reverse voltage protection.



APPLICATION NOTES — DC-DC Converters

PARALLEL OPERATION

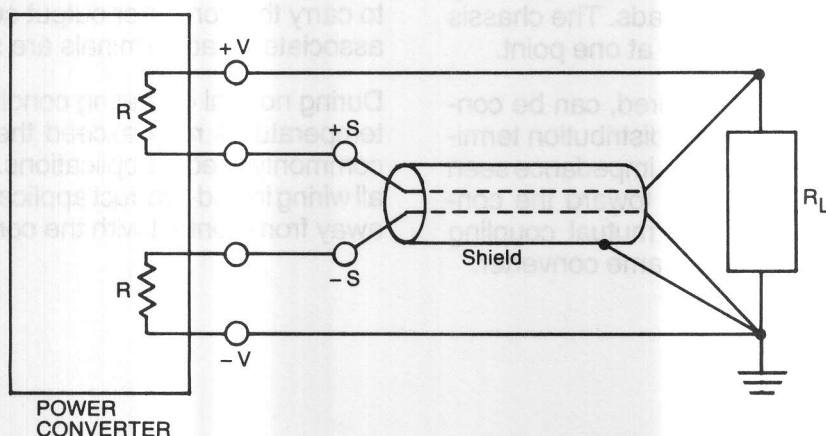
Parallel operation is the use of two or more constant voltage dc-dc converters of the same output voltage to obtain a higher output current than that available from either converter alone. Such operation is normally infeasible due to the large circulating current that results

from a small voltage difference between two low-impedance sources. However, if the two converters are specifically designed for such operation, they may share the load.

REMOTE SENSING

A constant-voltage dc-dc converter monitors and regulates its output voltage directly at the load terminals. Two low-current sensing leads between the load terminals, and special sensing terminals on the converter,

permit the converter output to compensate for IR drops in load leads. Shielding can be provided to prevent noise pick-up by the regulation circuit of the converter.



THERMAL MANAGEMENT

Good engineering design practice must be followed to ensure optimum converter performance. Heat, generated by internal power dissipation, must be effectively removed to prevent excessive component temperature rise. The amount of input power dissipated as heat depends on the efficiency of the power supply. Efficiency is the ratio of output power to input power, expressed as a percentage.

$$\eta = P_O / P_{IN} \times 100\%$$

Internal power losses are given by $P_D = P_{IN} - P_O$ or $P_D = P_O (100 - \eta) / \eta$. Transformers, series-pass regulators,

rectifiers, and switching transistor junctions are major contributors to internal power dissipation.

The internal temperature of components may be much higher than ambient temperature under normal operating conditions. Care must be taken never to exceed a component's maximum operating temperature in the application of a power supply.

When the ambient temperature of air around a power supply is known, other design factors affecting operating temperature can be determined. These include component spacing, heat sink requirements, and the need for forced air cooling or derated operation.

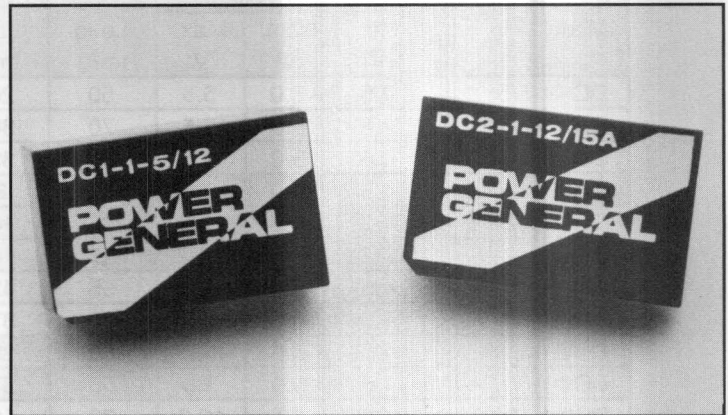
1W SINGLE AND DUAL OUTPUT DC-DC CONVERTERS

FEATURES

- Indefinite Short-Circuit Protection
- 500 VDC Input/Output Isolation
- Pi Input Filter
- Tight Line/Load Regulation
- Low-Noise Operation
- 24-Pin DIP Compatible
- 5-Year Warranty
- **737,000 Hours Minimum MTBF**

APPLICATIONS

- A/D and D/A Converters
- Operational Amplifiers
- RS232 Loop Drivers
- Bias Power for RAMs, ROMs, PROMs



All DC1-1 and DC2-1 models have a phenolic, UL94V-rated case and are encapsulated with a flame-retardant potting material.

GENERAL SPECIFICATIONS

DC INPUT VOLTAGE	See voltage/current rating chart.
INPUT CURRENT	See voltage/current rating chart.
EMI FILTER	Pi input filter, standard.
DC OUTPUT	See voltage/current rating chart.
CONTINUOUS OUTPUT POWER	1watt, maximum.
OUTPUT VOLTAGE TOLERANCE	±5 percent.
EFFICIENCY	50 percent, minimum.
CURRENT LIMIT	Output thermal limited.
NOISE & RIPPLE	35 mV _{pp} , maximum.
LINE REGULATION	See voltage/current rating chart.
LOAD REGULATION	See voltage/current rating chart.
CROSS-REGULATION	±0.1 percent, maximum.
ISOLATION VOLTAGE	500 VDC, input to output.
ISOLATION CAPACITANCE	100 pF, typical.
TRANSIENT RESPONSE	50 μs, maximum, to within 1 percent of V _{OUT} with 25 percent step load change. (See Note 4, voltage/current rating chart.)

ENVIRONMENTAL OPERATING CHARACTERISTICS

TEMPERATURE RANGE	-25°C to +70°C, no derating.
TEMPERATURE COEFFICIENT	±0.02 percent/°C.
COOLING	Free-air convection.
RELATIVE HUMIDITY	0 to 95 percent, non-condensing.
ALTITUDE	0 to 10,000 feet.

STORAGE CHARACTERISTICS

TEMPERATURE RANGE	-40°C to +100°C.
RELATIVE HUMIDITY	0 to 95 percent, non-condensing.

RELIABILITY

MEAN TIME BETWEEN FAILURES	>1,140,000 hours for single output models, >737,000 hours for dual output models, per MIL-HDBK 217E Parts Stress Method. (Ground benign, T _A =+25°C.)
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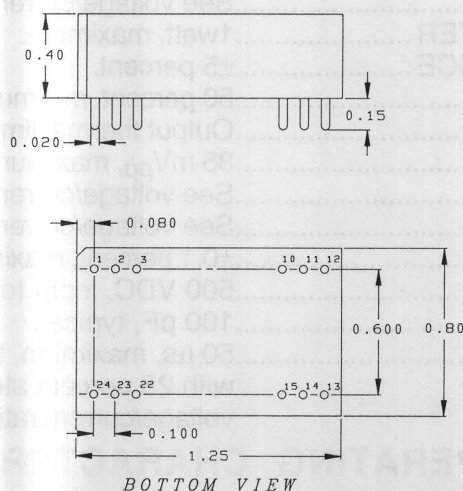
DC1-1 AND DC2-1 SERIES

Model Number	DC Input Voltage			Input Current		Max. Reflected Ripple (mA pp)	DC Output Voltage (V)	Output Current (mA)	Line Reg. (LL-HL)	Load Reg. (NL-FL)
	Min. (V)	Nom. (V)	Max. (V)	No Load (mA)	Full Load (mA)					
DC1-1-5/5	4.5	5.0	5.5	50	200	30	5.0	100	0.2%	0.1%
DC1-1-5/12	4.5	5.0	5.5	70	385	30	12	80	0.8%	0.8%
DC1-1-5/15	4.5	5.0	5.5	50	390	30	15	65	0.8%	0.8%
DC1-1-12/5	4.5	5.0	5.5	15	84	30	5.0	100	0.2%	0.2%
DC1-1-12/12	10.8	12	13.2	25	160	30	12	80	0.8%	0.8%
DC1-1-12/15	10.8	12	13.2	20	160	30	15	65	0.8%	0.8%
DC2-1-5/12	4.5	5.0	5.5	55	425	35	±12	40	0.2%	0.2%
DC2-1-5/12A	4.5	5.0	5.5	35	370	35	±12	40	0.2%	0.2%
DC2-1-5/15	4.5	5.0	5.5	50	385	35	±15	33	0.2%	0.2%
DC2-1-5/15A	4.5	5.0	5.5	55	370	35	±15	33	0.2%	0.2%
DC2-1-12/12	10.8	12	13.2	30	150	35	±12	40	0.2%	0.2%
DC2-1-12/12A	10.8	12	13.2	20	130	35	±12	40	0.2%	0.2%
DC2-1-12/15	10.8	12	13.2	30	155	35	±15	33	0.2%	0.2%
DC2-1-12/15A	10.8	12	13.2	25	130	35	±15	33	0.2%	0.2%

Notes:

1. Converters with ±12V or ±15V output can be used as 24V or 30V supplies.
2. Total output power must not exceed 1 watt.
3. All measurements are at nominal input and full load, unless otherwise specified.
4. Maximum transient response deviation is 10 mV for 5.0V output and 150 mV for 12V and 15V output.

MECHANICAL OUTLINE AND PIN CONFIGURATION



Notes:

1. Dimensions shown are in inches.
2. Tolerance = 0.00 ±0.01.
0.000 ±0.005.
3. Module weight = 0.5 oz (0.014 kg).

PIN-OUT

Single Output Models		Dual Output Models With Suffix 'A'		Dual Output Models Without Suffix 'A'	
Pin	Designation	Pin	Designation	Pin	Designation
1, 24	+ V IN	1, 2, 3	+ V IN	1, 24	+ V IN
12, 13	- V IN	22, 23, 24	- V IN	12, 13	- V IN
11, 14	+ V OUT	15	+ V OUT	11, 14	+ V1 OUT
10, 15	- V OUT	13	- V OUT	10, 15	- V1 OUT
2, 3, 22, 23	NO CONNECTION	10, 11	COMMON	3, 22	+ V2 OUT
		12, 14	N/C	2, 23	- V2 OUT

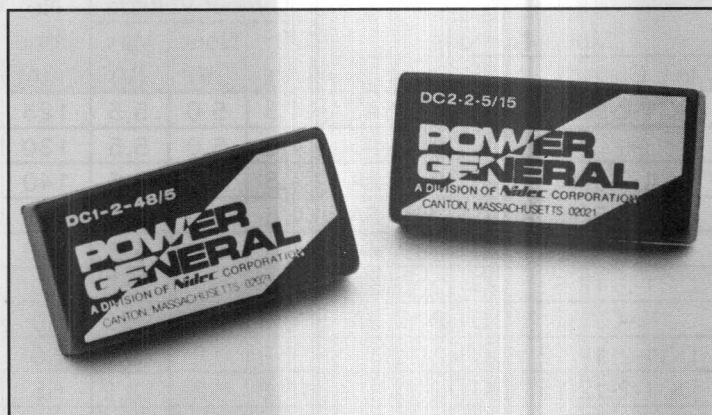
2W SINGLE AND DUAL OUTPUT DC-DC CONVERTERS

FEATURES

- Indefinite Short-Circuit Protection
- 500 VDC Input/Output Isolation
- Pi Input Filter
- Tight Line/Load Regulation
- Continuous Shielding, Copper Case
- Compact 1" x 2" x 0.38" Package
- 5-Year Warranty
- **800,000 Hours Minimum MTBF**

APPLICATIONS

- Board Level Subsystems
- Portable/Battery Driven Equipment
- Telecommunications Equipment
- Data Communications Equipment



DC1-2 and DC2-2 models have a copper case with six-sided shielding and are encapsulated with a flame-retardant epoxy.

GENERAL SPECIFICATIONS

DC INPUT VOLTAGE	See voltage/current rating chart.
INPUT CURRENT	See voltage/current rating chart.
REFLECTED RIPPLE CURRENT	25 mApp, maximum.
EMI FILTER	Pi input filter, standard.
DC OUTPUT	See voltage/current rating chart.
CONTINUOUS OUTPUT POWER	2 watts, maximum.
OUTPUT VOLTAGE TOLERANCE	±3 percent (DC1-2); ±2 percent (DC2-2).
OUTPUT VOLTAGE BALANCE	±4 percent, maximum (DC2-2).
EFFICIENCY	See voltage/current rating chart.
CURRENT LIMIT	Pulsed overload (DC1-2); thermal limited (DC2-2).
OUTPUT NOISE & RIPPLE	30 mVpp, maximum.
LINE/LOAD REGULATION	See voltage/current rating chart.
CROSS-REGULATION	±0.1 percent, maximum (DC2-2).
ISOLATION VOLTAGE	500 VDC, input to output.
ISOLATION CAPACITANCE	100 pF, typical.
TRANSIENT RESPONSE	50 µs, maximum, to within 1 percent of VOUT with 25 percent step load change. (See Note 5.)
FREQUENCY OF OPERATION	45-55 kHz.

ENVIRONMENTAL OPERATING CHARACTERISTICS

TEMPERATURE RANGE	-25°C to +70°C, no derating.
TEMPERATURE COEFFICIENT	±0.02 percent/°C.
COOLING	Free-air convection.
RELATIVE HUMIDITY	0 to 95 percent, non-condensing.
ALTITUDE	0 to 10,000 feet.

STORAGE CHARACTERISTICS

TEMPERATURE RANGE	-40°C to +100°C.
RELATIVE HUMIDITY	0 to 95 percent, non-condensing.

RELIABILITY

MEAN TIME BETWEEN FAILURES	>800,000 hours, per MIL-HDBK 217E Parts Stress Method. (Ground benign, TA=+25°C.)
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DC1-2 AND DC2-2 SERIES

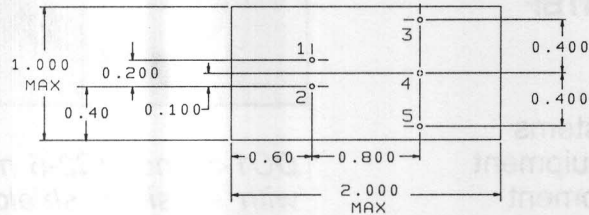
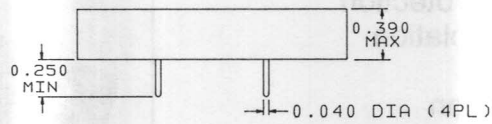
Model Number		DC Input Voltage			Input Current		DC Output Voltage (V)	Output Current (mA)	Line Reg. (LL-HL)	Load Reg. (NL-FL)	Efficiency
		Min. (V)	Nom. (V)	Max. (V)	No Load (mA)	Full Load (mA)					
In L Case	In M Case										
DC1-2-5/5	DC1-2-5/5A	4.5	5.0	5.5	125	700	5.0	400	±0.1%	±0.1%	57%
—	DC1-2-5/9A	4.5	5.0	5.5	130	640	9.0	222	±0.1%	±0.1%	63%
DC1-2-5/12	DC1-2-5/12A	4.5	5.0	5.5	140	640	12	167	±0.1%	±0.1%	62%
DC1-2-5/15	DC1-2-5/15A	4.5	5.0	5.5	145	640	15	133	±0.1%	±0.1%	62%
—	DC1-2-5/24A	4.5	5.0	5.5	160	668	24	83	±0.1%	±0.1%	60%
DC1-2-12/5	DC1-2-12/5A	10.8	12	13.2	60	300	5.0	400	±0.1%	±0.1%	57%
—	DC1-2-12/9A	10.8	12	13.2	60	285	9.0	222	±0.1%	±0.1%	60%
DC1-2-12/12	DC1-2-12/12A	10.8	12	13.2	60	275	12	167	±0.1%	±0.1%	60%
DC1-2-12/15	DC1-2-12/15A	10.8	12	13.2	65	275	15	133	±0.1%	±0.1%	60%
—	DC1-2-12/24A	10.8	12	13.2	68	275	24	83	±0.1%	±0.1%	61%
DC1-2-24/5	DC1-2-24/5A	21.6	24	26.4	20	135	5.0	400	±0.1%	±0.1%	62%
—	DC1-2-24/9A	21.6	24	26.4	20	130	9.0	222	±0.1%	±0.1%	67%
DC1-2-24/12	DC1-2-24/12A	21.6	24	26.4	25	128	12	167	±0.1%	±0.1%	66%
DC1-2-24/15	DC1-2-24/15A	21.6	24	26.4	25	125	15	133	±0.1%	±0.1%	67%
—	DC1-2-24/24A	21.6	24	26.4	28	130	24	83	±0.1%	±0.1%	65%
—	DC1-2-28/5A	25.2	28	30.8	18	120	5.0	400	±0.1%	±0.1%	64%
—	DC1-2-28/9A	25.2	28	30.8	23	110	9.0	222	±0.1%	±0.1%	65%
—	DC1-2-28/12A	25.2	28	30.8	22	110	12	167	±0.1%	±0.1%	67%
—	DC1-2-28/15A	25.2	28	30.8	22	108	15	133	±0.1%	±0.1%	67%
—	DC1-2-28/24A	25.2	28	30.8	25	110	24	83	±0.1%	±0.1%	65%
DC1-2-48/5	DC1-2-48/5A	43.2	48	52.8	13	70	5.0	400	±0.1%	±0.1%	61%
—	DC1-2-48/9A	43.2	48	52.8	12	62	9.0	222	±0.1%	±0.1%	67%
—	DC1-2-48/12A	43.2	48	52.8	12	62	12	167	±0.1%	±0.1%	68%
—	DC1-2-48/15A	43.2	48	52.8	12	61	15	133	±0.1%	±0.1%	69%
—	DC1-2-48/24A	43.2	48	52.8	17	65	24	83	±0.1%	±0.1%	65%
DC2-2-5/12	—	4.5	5.0	5.5	115	700	±12	80	±0.2%	±0.2%	58%
DC2-2-5/15	—	4.5	5.0	5.5	115	700	±15	65	±0.2%	±0.2%	58%
DC2-2-12/12	—	10.8	12	13.2	38	286	±12	80	±0.2%	±0.2%	58%
DC2-2-12/15	—	10.8	12	13.2	40	285	±15	65	±0.2%	±0.2%	59%
DC2-2-24/12	—	21.6	24	26.4	20	138	±12	80	±0.2%	±0.2%	60%
DC2-2-24/15	—	21.6	24	26.4	20	135	±15	65	±0.2%	±0.2%	63%
DC2-2-28/12	—	25.2	28	30.8	20	120	±12	80	±0.2%	±0.2%	60%
DC2-2-28/15	—	25.2	28	30.8	20	116	±15	65	±0.2%	±0.2%	62%
DC2-2-48/12	—	43.2	48	52.8	14	70	±12	80	±0.2%	±0.2%	60%
DC2-2-48/15	—	43.2	48	52.8	14	70	±15	65	±0.2%	±0.2%	61%

Notes:

1. Converters with ±12V or ±15V output can be used as 24V or 30V supplies.
2. Total output power must not exceed 2 watts.
3. All measurements are at nominal input, full load and +25°C, unless otherwise specified.
4. Peak-to-peak and RMS metering equipment shall have a 20 MHz response with probes and cables maintaining a frequency response of 20 Hz to 20 MHz. Output ripple and spikes are measured directly at the output terminals of the power supply across a 0.1 µF ceramic capacitor without use of the probe ground.
5. Maximum transient response deviation=10 mV for DC1-2, 150 mV for DC2-2.

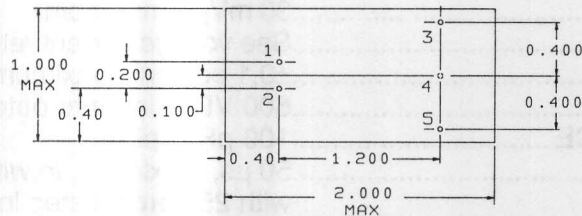
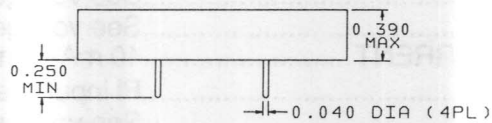
MECHANICAL OUTLINE AND PIN CONFIGURATION

L CASE



BOTTOM VIEW

M CASE



BOTTOM VIEW

Notes:

1. Dimensions shown are in inches.
2. Tolerance = 0.00 \pm 0.02.
0.000 \pm 0.005.
3. Module weight = 0.9 oz (0.026 kg).

PIN-OUT

Single Output 'L' Case		Single Output 'M' Case		Dual Output 'L' Case	
Pin	Designation	Pin	Designation	Pin	Designation
1	+ V IN	1	- V IN	1	+ V IN
2	- V IN	2	+ V IN	2	- V IN
3	+ V OUT	3	- V OUT	3	+ V OUT
4	No Pin	4	No Pin	4	COMMON
5	- V OUT	5	+ V OUT	5	- V OUT

DC1-5 AND DC2-5 SERIES

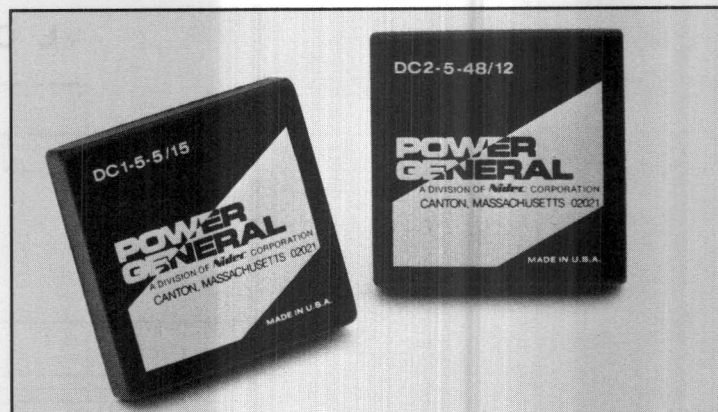
5W SINGLE AND DUAL OUTPUT DC-DC CONVERTERS

FEATURES

- Indefinite Short-Circuit Protection
- 500 VDC Input/Output Isolation
- Pi Input Filter
- Tight Line/Load Regulation
- Continuous Shielding, Copper Case
- Compact 2" x 2" x 0.38" Package
- 5-Year Warranty
- **330,000 Hours Minimum MTBF**

APPLICATIONS

- Microprocessor-Based Systems
- Portable/Battery Driven Equipment
- Telecommunications Equipment
- Data Communications Equipment



DC1-5 and DC2-5 models have a copper case with six-sided shielding and are encapsulated with a flame-retardant epoxy.

GENERAL SPECIFICATIONS

DC INPUT VOLTAGE	See voltage/current rating chart.
INPUT CURRENT	See voltage/current rating chart.
REFLECTED RIPPLE CURRENT	40 mApp, maximum.
EMI FILTER.....	Pi input filter, standard.
DC OUTPUT	See voltage/current rating chart.
OUTPUT VOLTAGE TOLERANCE	±0.5 percent.
EFFICIENCY	See voltage/current rating chart.
CURRENT LIMIT	Pulsed overload.
NOISE & RIPPLE	30 mV _{pp} , maximum.
LINE/LOAD REGULATION	See voltage/current rating chart.
CROSS-REGULATION.....	±0.1 percent, maximum (DC2-5).
ISOLATION VOLTAGE	500 VDC, input to output.
ISOLATION CAPACITANCE	100 pF, typical.
TRANSIENT RESPONSE.....	50 μ s, maximum, to within 1 percent of V _{OUT} with 25 percent step load change. (See Note 4.)
FREQUENCY OF OPERATION.....	45-55 kHz.

ENVIRONMENTAL OPERATING CHARACTERISTICS

TEMPERATURE RANGE	-25°C to +70°C, no derating.
TEMPERATURE COEFFICIENT	±0.02 percent/°C.
COOLING	Free-air convection.
RELATIVE HUMIDITY	0 to 95 percent, non-condensing.
ALTITUDE	0 to 10,000 feet.

STORAGE CHARACTERISTICS

TEMPERATURE RANGE	-40°C to +100°C.
RELATIVE HUMIDITY	0 to 95 percent, non-condensing.

RELIABILITY

MEAN TIME BETWEEN FAILURES	>330,000 hours, per MIL-HDBK 217E Parts Stress Method. (Ground benign, T _A =+25°C.)
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DC1-5 AND DC2-5 SERIES

Model Number	DC Input Voltage			Input Current		DC Output Voltage (V)	Output Current (mA)	Max. Output Power (W)	Line Reg. (LL-HL)	Load Reg. (NL-FL)	Efficiency
	Min. (V)	Nom. (V)	Max. (V)	No Load (mA)	Full Load (mA)						
DC1-5-5/5	4.75	5.0	5.5	175	1500	5.0	1000	5.0	0.1%	0.1%	67%
DC1-5-5/9	4.75	5.0	5.5	175	1550	9.0	600	5.4	0.1%	0.1%	70%
DC1-5-5/12	4.75	5.0	5.5	175	1700	12	500	6.0	0.1%	0.1%	71%
DC1-5-5/15	4.75	5.0	5.5	180	1650	15	400	6.0	0.1%	0.1%	73%
DC1-5-12/5	10.8	12	13.2	60	620	5.0	1000	5.0	0.1%	0.1%	68%
DC1-5-12/9	10.8	12	13.2	60	675	9.0	600	5.4	0.1%	0.1%	68%
DC1-5-12/12	10.8	12	13.2	60	715	12	500	6.0	0.1%	0.1%	69%
DC1-5-12/15	10.8	12	13.2	75	705	15	400	6.0	0.1%	0.1%	71%
DC1-5-24/5	21.6	24	26.4	25	315	5.0	1000	5.0	0.1%	0.1%	67%
DC1-5-24/9	21.6	24	26.4	25	310	9.0	600	5.4	0.1%	0.1%	74%
DC1-5-24/12	21.6	24	26.4	30	335	12	500	6.0	0.1%	0.1%	75%
DC1-5-24/15	21.6	24	26.4	30	350	15	400	6.0	0.1%	0.1%	73%
DC1-5-28/5	25.2	28	30.8	25	260	5.0	1000	5.0	0.1%	0.1%	69%
DC1-5-28/9	25.2	28	30.8	28	275	9.0	600	5.4	0.1%	0.1%	73%
DC1-5-28/12	25.2	28	30.8	30	370	12	500	6.0	0.1%	0.1%	71%
DC1-5-28/15	25.2	28	30.8	30	300	15	400	6.0	0.1%	0.1%	73%
DC1-5-48/5	43.2	48	52.8	18	165	5.0	1000	5.0	0.1%	0.1%	63%
DC1-5-48/9	43.2	48	52.8	18	160	9.0	600	5.4	0.1%	0.1%	73%
DC1-5-48/12	43.2	48	52.8	20	175	12	500	6.0	0.1%	0.1%	73%
DC1-5-48/15	43.2	48	52.8	20	170	15	400	6.0	0.1%	0.1%	75%
DC2-5-5/12	4.75	5.0	5.5	200	1850	±12	250	6.0	0.1%	0.1%	65%
DC2-5-5/15	4.75	5.0	5.5	210	1850	±15	200	6.0	0.1%	0.1%	65%
DC2-5-12/12	10.8	12	13.2	65	740	±12	250	6.0	0.1%	0.1%	67%
DC2-5-12/15	10.8	12	13.2	65	730	±15	200	6.0	0.1%	0.1%	69%
DC2-5-24/12	21.6	24	26.4	35	355	±12	250	6.0	0.1%	0.1%	70%
DC2-5-24/15	21.6	24	26.4	35	345	±15	200	6.0	0.1%	0.1%	72%
DC2-5-28/12	25.2	28	30.8	32	305	±12	250	6.0	0.1%	0.1%	71%
DC2-5-28/15	25.2	28	30.8	32	305	±15	200	6.0	0.1%	0.1%	74%
DC2-5-48/12	43.2	48	52.8	18	175	±12	250	6.0	0.1%	0.1%	71%
DC2-5-48/15	43.2	48	52.8	18	175	±15	200	6.0	0.1%	0.1%	72%

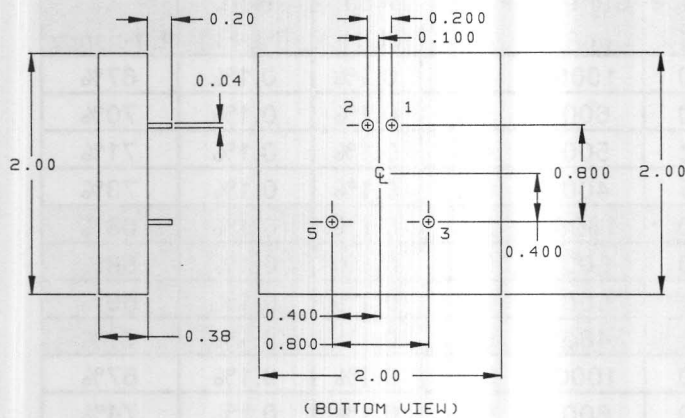
Notes:

1. Converters with $\pm 12V$ or $\pm 15V$ output can be used as 24V or 30V supplies.
2. Total output power must not exceed 5 watts.
3. All measurements are at nominal input, full load and $+25^{\circ}C$, unless otherwise specified.
4. Maximum deviation from transient response is 150 mV for DC1-5, 10 mV for DC2-5.
5. Peak-to-peak and RMS metering equipment shall have a 20 MHz response with probes and cables maintaining a frequency response of 20 Hz to 20 MHz. Output ripple and spikes are measured directly at the output terminals of the power supply across a 0.1 μF ceramic capacitor without use of the probe ground.

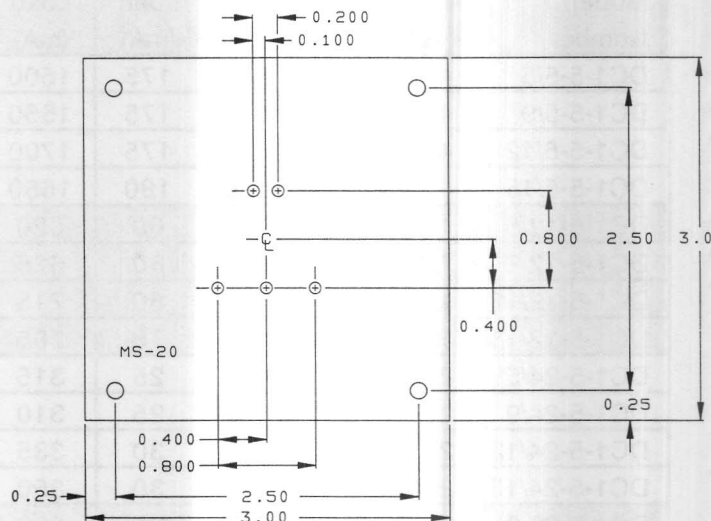
DC1-5 AND DC2-5 SERIES

MECHANICAL OUTLINE AND PIN CONFIGURATION

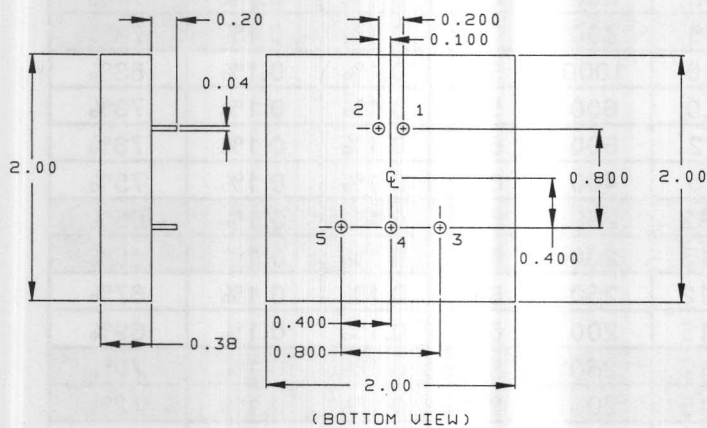
DC1-5 CASE



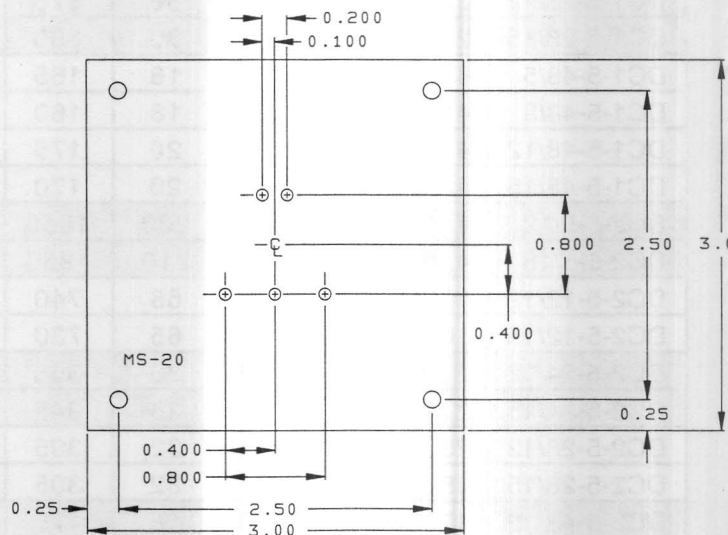
OPTIONAL SOCKET



DC2-5 CASE



OPTIONAL SOCKET



Notes:

1. Dimensions shown are in inches.
2. Tolerance = 0.00 \pm 0.02.
0.000 \pm 0.005.
3. Module weight = 1.6 oz (0.045 kg).

Socket Notes:

1. Socket mounting holes are 0.014" (3.56 mm) in diameter.
2. G10 board thickness is 0.09 inches (2.29 mm).
3. Receptacles extend 0.31 inches (7.87 mm) below surface of socket board.

PIN-OUT

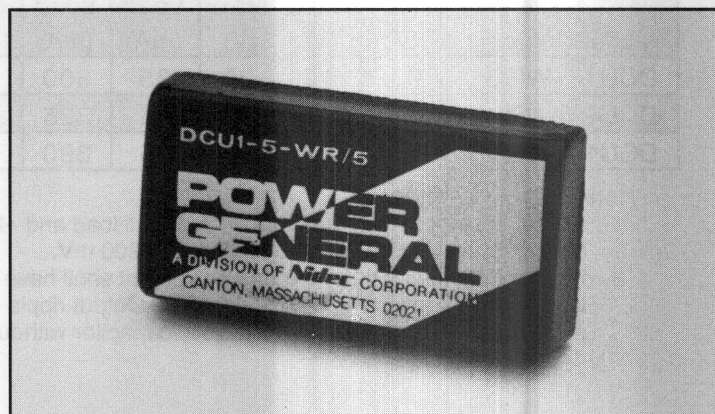
Single Output		Dual Output	
Pin	Designation	Pin	Designation
1	+ V IN	1	+ V IN
2	- V IN	2	- V IN
3	+ V OUT	3	+ V OUT
4	N/A	4	COMMON
5	- V OUT	5	- V OUT

5W SINGLE OUTPUT DC-DC CONVERTERS

—WIDE INPUT RANGE, NON-ISOLATED OUTPUT—

FEATURES

- Wide Input Voltage Range
- Short-Circuit Protection
- Pi Input Filter
- Tight Line/Load Regulation
- Low-Noise Operation
- High Efficiency
- Compact 1" x 2" x 0.38" Package
- 5-Year Warranty
- **250,000 Hours Minimum MTBF**



APPLICATIONS

- Battery-Operated Equipment
- Portable/Battery-Backed Gear

All DCU1-5 models have a copper case and are encapsulated with a flame-retardant material.

GENERAL SPECIFICATIONS

DC INPUT VOLTAGE	See voltage/current rating chart.
INPUT CURRENT	See voltage/current rating chart.
EMI FILTER	Pi input filter, standard.
REVERSE VOLTAGE PROTECTION	Internal shunt diode.
CASE GROUNDING	-V _{IN} to case.
DC OUTPUT	See voltage/current rating chart.
CONTINUOUS OUTPUT POWER	5 watts, maximum.
OUTPUT VOLTAGE TOLERANCE	±2 percent.
EFFICIENCY	74-80 percent.
CURRENT LIMIT	Pulsed overload.
OVER-VOLTAGE PROTECTION	5.0V model only. Internal clamp at 6.5V, typical.
NOISE & RIPPLE	75 mV _{pp} , maximum.
LINE/LOAD REGULATION	See voltage/current rating chart.
ISOLATION	Not galvanically isolated.
FREQUENCY OF OPERATION	100 kHz.
TRANSIENT RESPONSE	500 μs, maximum, to within 1 percent of V _{OUT} with 25 percent step load change. (See Note 2, voltage/current rating chart.)

ENVIRONMENTAL OPERATING CHARACTERISTICS

TEMPERATURE RANGE	-25°C to +70°C, no derating.
TEMPERATURE COEFFICIENT	±0.02 percent/°C.
COOLING	Free-air convection.
RELATIVE HUMIDITY	0 to 95 percent, non-condensing.
ALTITUDE	0 to 10,000 feet.

STORAGE CHARACTERISTICS

TEMPERATURE RANGE	-40°C to +100°C.
RELATIVE HUMIDITY	0 to 95 percent, non-condensing.

RELIABILITY

MEAN TIME BETWEEN FAILURES	>250,000 hours, per MIL-HDBK 217E Parts Stress Method. (Ground benign, T _A =+25°C.)
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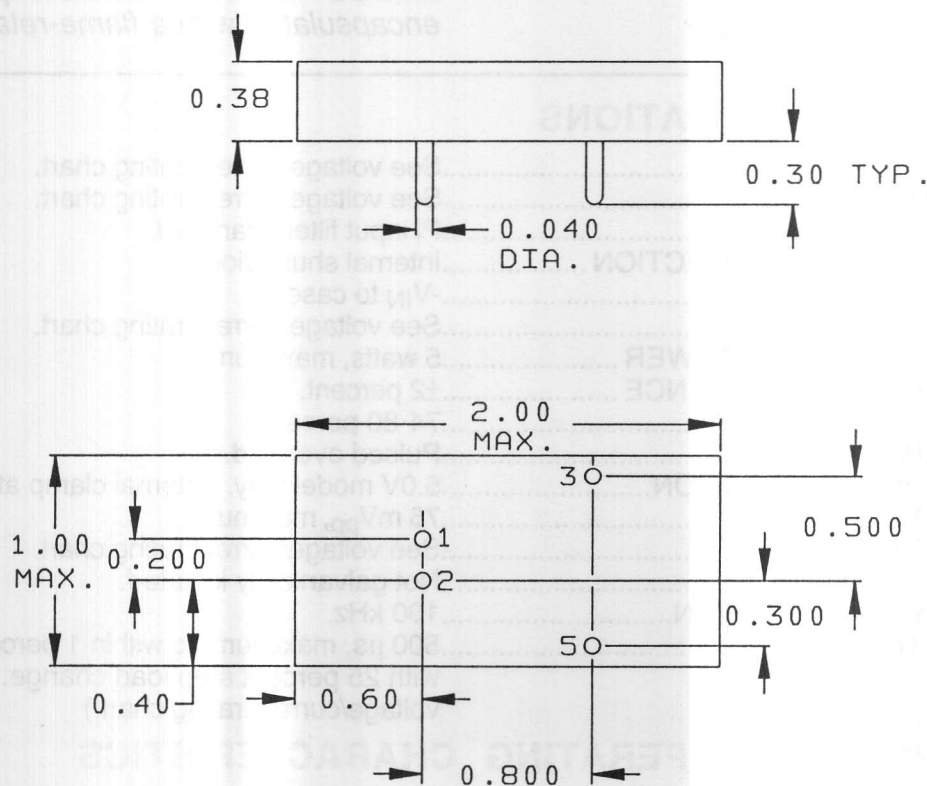
DCU1-5 SERIES

Model Number	DC Input Voltage			Input Current		Max.	DC	Output	Line	Load	Efficiency
	Min. (V)	Nom. (V)	Max. (V)	No Load (mA)	Full Load (mA)	Reflected Ripple (mA pp)	Output Voltage (V)	Current (mA)	Reg. (LL-HL)	Reg. (NL-FL)	
DCU1-5-WR/5	7.0	12	32	25	600	50	5.0	1000	±0.5%	±0.5%	74%
DCU1-5-WR/12	14	24	32	25	325	50	12	600	±0.5%	±0.5%	78%
DCU1-5-WR/15	17	24	32	25	390	50	15	500	±0.5%	±0.5%	80%

Notes:

1. All measurements are at nominal input, full load and +25°C, unless otherwise specified.
2. Maximum transient response deviation is 200 mV.
3. Peak-to-peak and RMS metering equipment shall have a 20 MHz response with probes and cables maintaining a frequency response of 20 Hz to 20 MHz. Output ripple and spikes are measured directly at the output terminals of the power supply across a 0.1 µF ceramic capacitor without use of the probe ground.

MECHANICAL OUTLINE AND PIN CONFIGURATION



BOTTOM VIEW

PIN-OUT

Pin	Designation
1	+ V IN
2	- V IN
3	+ V OUT
4	NO PIN
5	- V OUT

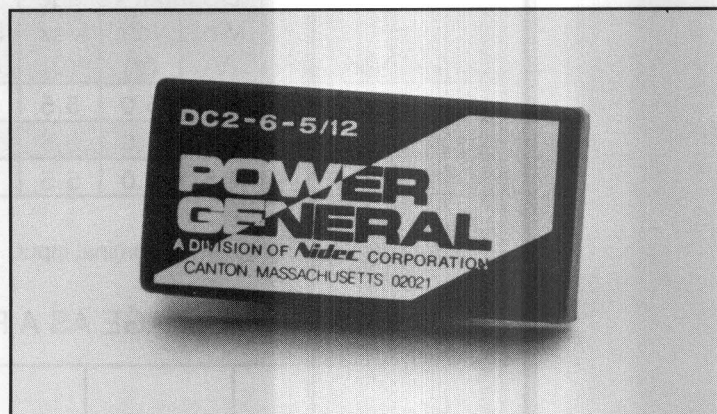
Notes:

1. Dimensions shown are in inches.
2. Tolerance = 0.00 ±0.02.
0.000 ±0.005.
3. Module weight = 1.5 oz (0.043 kg).
4. Optional socket for DCU1-5 is available. For information, contact Power General.

6W DUAL OUTPUT DC-DC CONVERTERS

FEATURES

- Isolated Dual Outputs
- 500 VDC Input/Output Isolation
- 8W/in³ Power Density
- 80% Efficiency
- Pi Input Filter
- Short-Circuit Protection
- Compact 1" x 2" x 0.38" Package
- 5-Year Warranty
- **325,000 Hours Minimum MTBF**



APPLICATIONS

- Microprocessor-Based Systems
- Telecommunications Equipment
- Data Communications Equipment

All DC2-6 models have a copper case with six-sided shielding and are encapsulated with a flame-retardant potting material.

GENERAL SPECIFICATIONS

DC INPUT VOLTAGE	See voltage/current rating chart.
INPUT VOLTAGE TOLERANCE	±10 percent.
INPUT CURRENT	See voltage/current rating chart.
EMI FILTER	Pi input filter, standard.
DC OUTPUT	See voltage/current rating chart.
OUTPUT VOLTAGE TOLERANCE	±3 percent (5.0V input, full load conditions).
CONTINUOUS OUTPUT POWER	6 watts, maximum.
EFFICIENCY	80 percent.
SHORT-CIRCUIT PROTECTION	30 seconds. For longer protection, an external 2.0A/125V fuse may be used.
NOISE & RIPPLE	100 mV _{pp} , maximum.
LINE REGULATION	Proportional to input.
LOAD REGULATION	See graph.
ISOLATION VOLTAGE	500 VDC, input to ground.
ISOLATION CAPACITANCE	100 pF, typical.
FREQUENCY OF OPERATION	50 kHz.

ENVIRONMENTAL OPERATING CHARACTERISTICS

TEMPERATURE RANGE	-25°C to +70°C, no derating.
TEMPERATURE COEFFICIENT	±0.02 percent/°C.
COOLING	Free-air convection.
RELATIVE HUMIDITY	0 to 95 percent, non-condensing.
ALTITUDE	0 to 10,000 feet.

STORAGE CHARACTERISTICS

TEMPERATURE RANGE	-40°C to +100°C.
RELATIVE HUMIDITY	0 to 95 percent, non-condensing.

RELIABILITY

MEAN TIME BETWEEN FAILURES	>325,000 hours, per MIL-HDBK 217E Parts Stress Method. Ground benign, T _A =+25°C.)
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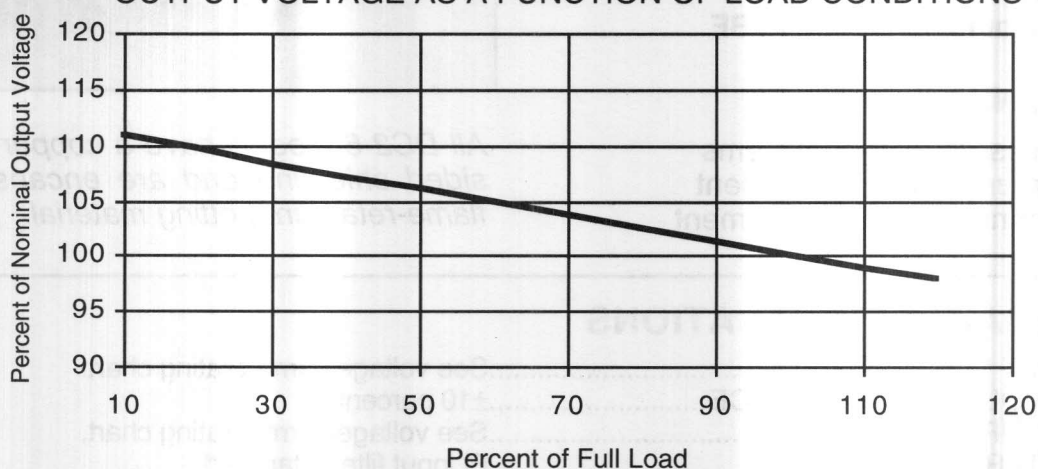
DC2-6 SERIES

Model Number	DC Input Voltage			Input Current		Max. Reflected Ripple (mA pp)	DC Output Voltage (V)	Output Current (mA)
	Min. (V)	Nom. (V)	Max. (V)	No Load (mA)	Full Load (mA)			
DC2-6-5/12	4.5	5.0	5.5	95	1500	10	±12	250
DC2-6-5/15	4.5	5.0	5.5	95	1500	10	±15	200
DC2-6-5/18	4.5	5.0	5.5	100	1500	10	±18	165

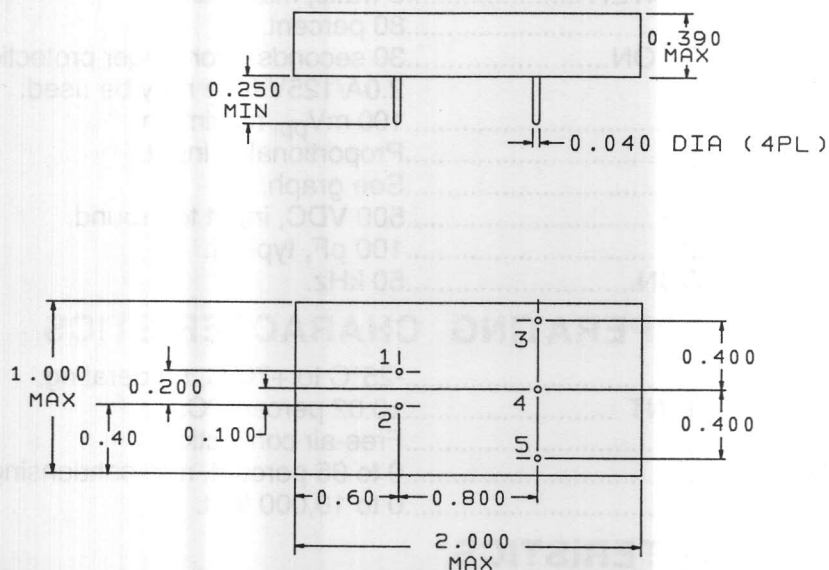
Notes:

1. All measurements are at nominal input, full load and +25°C, unless otherwise specified.

OUTPUT VOLTAGE AS A FUNCTION OF LOAD CONDITIONS



MECHANICAL OUTLINE AND PIN CONFIGURATION



PIN-OUT

Pin	Designation
1	+ V IN
2	- V IN
3	+ V OUT
4	COMMON
5	- V OUT

BOTTOM VIEW

Notes:

1. Dimensions shown are in inches.
2. Tolerance = 0.00 ±0.02.
0.000 ±0.005.
3. Module weight = 1.5 oz (0.043 kg).

50W TRIPLE OUTPUT DC-DC CONVERTERS

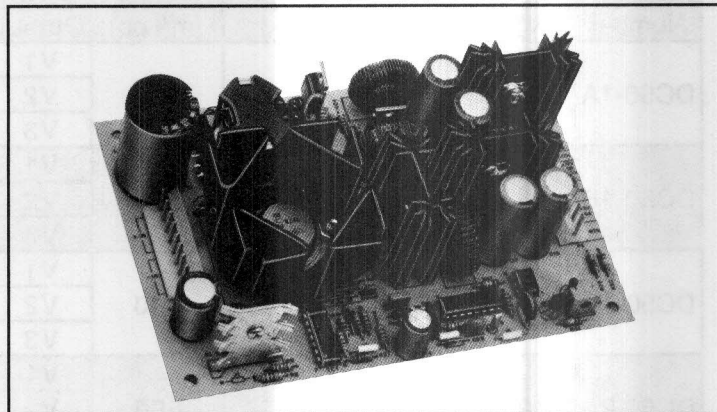
—HIGH PERFORMANCE, LOW COST—

FEATURES

- 2:1 Input Voltage Range
- 3 Isolated Outputs
- 2500 VDC Input/Output Isolation
- External Synch and Disable
- Tight Line/Load Regulation
- Under-Voltage Protection
- Over-Voltage Shutdown
- Short-Circuit Protection

APPLICATIONS

- Telecommunications Equipment
- Process Control Systems
- Portable/Battery-Operated Equipment



All DC50 models are open-frame converters in a compact 4 x 6 x 1.75-inch format.

GENERAL SPECIFICATIONS

DC INPUT VOLTAGE	See voltage/current rating chart.
INPUT CURRENT	See voltage/current rating chart.
INPUT LINE PROTECTION.....	External fuse is recommended.
UNDER-VOLTAGE SHUTDOWN.....	10 percent below LOW line, typical.
OVER-VOLTAGE SHUTDOWN.....	10 percent above HIGH line, typical.
DC OUTPUT.....	See voltage/current rating chart.
CONTINUOUS OUTPUT POWER.....	50 watts, maximum.
OUTPUT VOLTAGE TOLERANCE.....	5.0V output adjustable ± 5 percent. Auxiliary outputs ± 4 percent, fixed.
SHORT-CIRCUIT PROTECTION.....	Outputs protected by input power-limit circuit.
NOISE & RIPPLE (100 kHz).....	DC50-1 and DC50-2, 5.0V output: 20 mV _{pp} , typical; auxiliary outputs: 5.0 mV _{pp} . For DC50-3 and DC50-4, all outputs: 20 mV _{pp} .
SPIKE (30 MHz).....	The greater of 1 percent or 150 mV _{pp} , typical.
LINE/LOAD REGULATION.....	See voltage/current rating chart.
ISOLATION VOLTAGE	2500 VDC, input to output.
EXTERNAL SHUTDOWN.....	TTL HIGH disables the unit.
EXTERNAL SYNCH.....	2.8V positive pulse ($>9.1 \mu s$) to the synch pin.
OPERATING FREQUENCY.....	100 kHz.

ENVIRONMENTAL OPERATING CHARACTERISTICS

TEMPERATURE RANGE	0°C to +70°C; derate each output 2 percent/°C from +40°C to +70°C.
TEMPERATURE COEFFICIENT	± 0.02 percent/°C.
COOLING.....	Free-air convection.
RELATIVE HUMIDITY.....	0 to 95 percent, non-condensing.
ALTITUDE.....	0 to 10,000 feet.

STORAGE CHARACTERISTICS

TEMPERATURE RANGE	-55°C to +100°C.
RELATIVE HUMIDITY.....	0 to 95 percent, non-condensing.

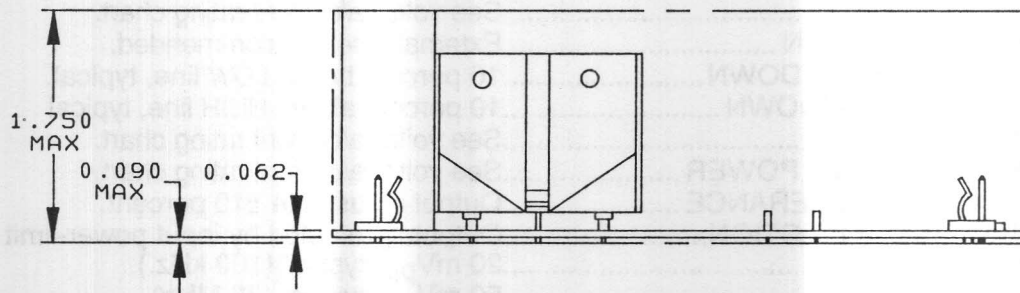
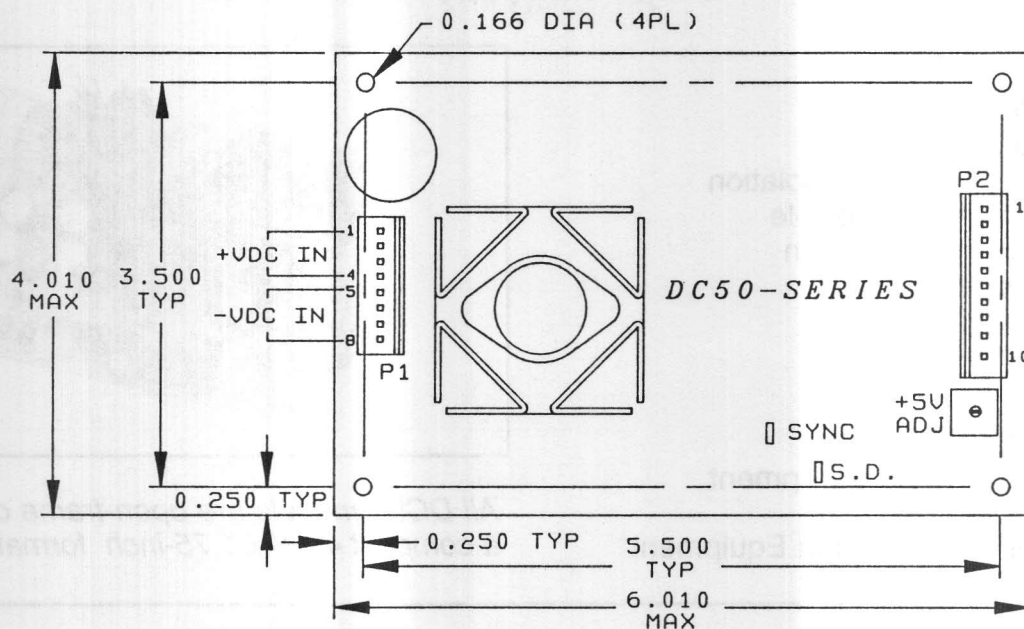
DC50 SERIES

Model Number	DC Input Voltage			Typ. Input Current (A)	Max. Reflected Ripple (mA pp)	Output Voltage		Output Current			Line Reg.	Load Reg.	Efficiency
	Min. (V)	Nom. (V)	Max. (V)					Min. (A)	Nom. (A)	Max. (A)			
	Output	(V)	(A)			(A)	(A)						
DC50-1A	10	12	18	4.9	500	V1	5.0	0.5	3.0	6.0	±0.2%	±0.2%	65%
						V2	12	0.1	1.0	1.0	±0.2%	±0.2%	
						V3	12	0.1	1.0	1.0	±0.2%	±0.2%	
DC50-1B	16	24	36	2.3	300	V1	5.0	0.5	3.0	6.0	±0.2%	±0.2%	69%
						V2	12	0.1	1.0	1.0	±0.2%	±0.2%	
						V3	12	0.1	1.0	1.0	±0.2%	±0.2%	
DC50-1C	34	48	72	1.2	300	V1	5.0	0.5	3.0	6.0	±0.2%	±0.2%	67%
						V2	12	0.1	1.0	1.0	±0.2%	±0.2%	
						V3	12	0.1	1.0	1.0	±0.2%	±0.2%	
DC50-2A	10	12	18	5.8	500	V1	5.0	0.5	3.0	6.0	±0.2%	±0.2%	64%
						V2	15	0.1	1.0	1.0	±0.2%	±0.2%	
						V3	15	0.1	1.0	1.0	±0.2%	±0.2%	
DC50-2B	16	24	36	2.7	300	V1	5.0	0.5	3.0	6.0	±0.2%	±0.2%	69%
						V2	15	0.1	1.0	1.0	±0.2%	±0.2%	
						V3	15	0.1	1.0	1.0	±0.2%	±0.2%	
DC50-2C	34	48	72	1.4	300	V1	5.0	0.5	3.0	6.0	±0.2%	±0.2%	67%
						V2	15	0.1	1.0	1.0	±0.2%	±0.2%	
						V3	15	0.1	1.0	1.0	±0.2%	±0.2%	
DC50-3A	10	12	18	4.9	500	V1	5.0	0.5	3.0	6.0	±0.2%	±0.2%	76%
						V2	12	0.2	2.0	3.0	±0.4%	±6.0%	
						V3	12	0.1	0.3	0.5	±0.4%	±6.0%	
DC50-3B	16	24	36	2.3	300	V1	5.0	0.5	3.0	6.0	±0.2%	±0.2%	80%
						V2	12	0.2	2.0	3.0	±0.4%	±6.0%	
						V3	12	0.1	0.3	0.5	±0.4%	±6.0%	
DC50-3C	34	48	72	1.2	300	V1	5.0	0.5	3.0	6.0	±0.2%	±0.2%	80%
						V2	12	0.2	2.0	3.0	±0.4%	±6.0%	
						V3	12	0.1	0.3	0.5	±0.4%	±6.0%	
DC50-4A	10	12	18	4.7	500	V1	5.0	0.5	3.0	6.0	±0.2%	±0.2%	76%
						V2	12	0.2	2.0	3.0	±0.2%	±6.0%	
						V3	5.0	0.2	0.5	1.0	±0.2%	±6.0%	
DC50-4B	16	24	36	2.3	300	V1	5.0	0.5	3.0	6.0	±0.2%	±0.2%	80%
						V2	12	0.2	2.0	3.0	±0.2%	±6.0%	
						V3	5.0	0.2	0.5	1.0	±0.2%	±6.0%	
DC50-4C	34	48	72	1.1	300	V1	5.0	0.5	3.0	6.0	±0.2%	±0.2%	80%
						V2	12	0.2	2.0	3.0	±0.2%	±6.0%	
						V3	5.0	0.2	0.5	1.0	±0.2%	±6.0%	

Notes:

1. Total output power must not exceed 50 watts.
2. All measurements are at nominal input and nominal load and +25°C, unless otherwise specified.
3. Load regulation is measured from nominal to maximum or minimum load with other outputs held at nominal load.
4. Peak-to-peak and RMS metering equipment shall have a 20 MHz response with probes and cables maintaining a frequency response of 20 Hz to 20 MHz. Output ripple and spikes are measured directly at the output terminals of the power supply across a 0.1 µF ceramic capacitor without use of the probe ground.
5. External input line fuse is recommended: for 12V input, use 10A /125V fuse; for 24V input, use 5A /125V fuse; for 48V input, use 3A /125V fuse.

MECHANICAL OUTLINE AND PIN CONFIGURATION



Notes:

1. Dimensions shown are in inches.
2. Tolerance = 0.00 ±0.02.
0.000 ±0.005.

PIN-OUT

P2 Output Connector	
Pin	All Models
1	V3
2	V3 RETURN
3	V2
4	
5	V2
6	RETURN
7	V1
8	
9	V1
10	RETURN

CONNECTORS

P1 Input Connector

Pins 1-4	Pins 5-8
+V IN	-V IN
MOLEX Mating Connector	
Housing	09-50-3081
Crimp Terminal	03-50-0106

P2 Output Connector

MOLEX Mating Connector	
Housing	09-50-3101
Crimp Terminal	08-50-0106

WEIGHT

Model	Ounces	Kilograms
DC50-1A	11.0	0.31
DC50-1B	11.5	0.33
DC50-1C	11.5	0.33
DC50-2A	11.0	0.31
DC50-2B	11.5	0.33
DC50-2C	11.5	0.33
DC50-3A	9.5	0.27
DC50-3B	10.0	0.28
DC50-3C	10.0	0.28
DC50-4A	9.5	0.27
DC50-4B	10.0	0.28
DC50-4C	10.0	0.28

DC60 SERIES

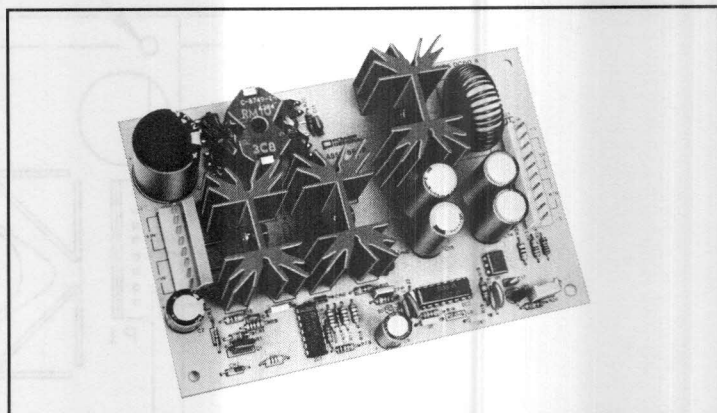
50W-72W SINGLE OUTPUT DC-DC CONVERTERS —HIGH PERFORMANCE, LOW COST—

FEATURES

- 2:1 Input Voltage Range
- 50-72W Output Power
- 2500 VDC Input/Output Isolation
- External Synch and Disable
- Tight Line/Load Regulation
- Under-Voltage Protection
- Over-Voltage Shutdown
- Short-Circuit Protection

APPLICATIONS

- Telecommunications Equipment
- Process Control Systems
- Portable/Battery-Operated Equipment



All DC60 models are open-frame converters in a compact 4 x 6 x 1.75-inch format.

GENERAL SPECIFICATIONS

DC INPUT VOLTAGE	See voltage/current rating chart.
INPUT CURRENT	See voltage/current rating chart.
INPUT LINE PROTECTION	External fuse is recommended.
UNDER-VOLTAGE SHUTDOWN	10 percent below LOW line, typical.
OVER-VOLTAGE SHUTDOWN	10 percent above HIGH line, typical.
DC OUTPUT	See voltage/current rating chart.
CONTINUOUS OUTPUT POWER	See voltage/current rating chart.
OUTPUT VOLTAGE TOLERANCE	Output adjustable ± 10 percent.
SHORT-CIRCUIT PROTECTION	Outputs protected by input power-limit circuit.
NOISE & RIPPLE	20 mV _{pp} , typical (100 kHz.).
SPIKE	50 mV _{pp} , typical (30 MHz).
LINE REGULATION	± 0.2 percent, typical (LL-HL).
LOAD REGULATION	± 0.2 percent, typical (NL-FL).
ISOLATION VOLTAGE	2500 VDC, input to output.
EXTERNAL SHUTDOWN	TTL HIGH disables the unit.
EXTERNAL SYNCH	2.8V positive pulse ($>9.1 \mu s$) to the synch pin.
OPERATING FREQUENCY	100 kHz.

ENVIRONMENTAL OPERATING CHARACTERISTICS

TEMPERATURE RANGE	0°C to +70°C; derate 2 percent/°C from +40°C to +70°C.
TEMPERATURE COEFFICIENT	± 0.02 percent/°C.
COOLING	Free-air convection.
RELATIVE HUMIDITY	0 to 95 percent, non-condensing.
ALTITUDE	0 to 10,000 feet.

STORAGE CHARACTERISTICS

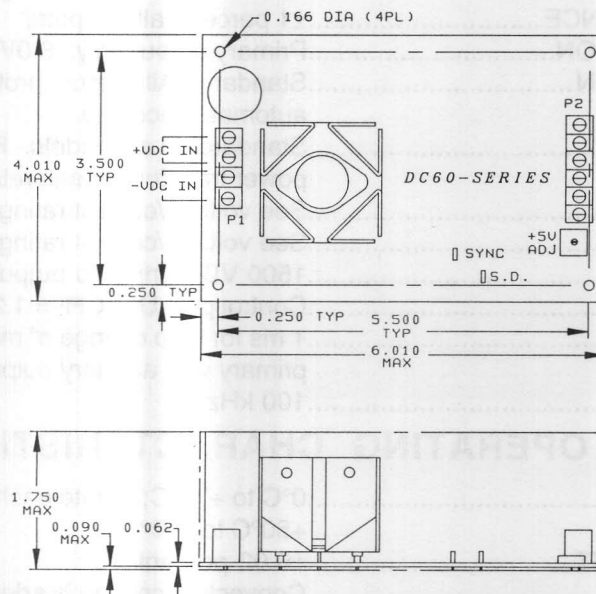
TEMPERATURE RANGE	-55°C to +100°C.
RELATIVE HUMIDITY	0 to 95 percent, non-condensing.

Model Number	DC Input Voltage			Typ. Input Current (A)	Max. Reflected Ripple (mA pp)	Output Voltage (V)	Max. Output Current (A)	Max. Output Power (W)	Efficiency	Weight	
	Min. (V)	Nom. (V)	Max. (V)							(oz)	(kg)
DC60-1A	10	12	18	5.8	150	5.0	10	50	70%	10.5	0.30
DC60-1B	18	24	36	3.4	150	5.0	12	60	74%	10.0	0.28
DC60-1C	36	48	72	1.7	150	5.0	12	60	74%	10.0	0.28
DC60-2A	10	12	18	6.9	200	12	5.0	60	72%	10.5	0.30
DC60-2B	18	24	36	3.7	200	12	6.0	72	80%	10.0	0.28
DC60-2C	36	48	72	1.8	200	12	6.0	72	82%	10.0	0.28
DC60-3A	10	12	18	6.9	200	15	4.0	60	72%	10.5	0.30
DC60-3B	18	24	36	3.7	200	15	4.8	72	81%	10.0	0.28
DC60-3C	36	48	72	1.8	200	15	4.8	72	82%	10.0	0.28
DC60-4A	10	12	18	6.2	200	24	2.5	60	80%	10.5	0.30
DC60-4B	18	24	36	3.5	200	24	3.0	72	85%	10.0	0.28
DC60-4C	36	48	72	1.8	200	24	3.0	72	82%	10.0	0.28

Notes:

1. All measurements are at nominal input and nominal load and +25°C, unless otherwise specified.
2. Input current is measured at nominal voltage, full load and +25°C.
3. Peak-to-peak and RMS metering equipment shall have a 20 MHz response with probes and cables maintaining a frequency response of 20 Hz to 20 MHz. Output ripple and spikes are measured directly at the output terminals of the power supply across a 0.1 μ F ceramic capacitor without use of the probe ground.
4. External input line fuse is recommended: for 12V input, use 10A /125V fuse; for 24V input, use 6A /125V fuse; for 48V input, use 4A /125V fuse.

MECHANICAL OUTLINE AND PIN CONFIGURATION



PIN-OUT

Pin	Function (P2)
1	+ SENSE
2	V OUT
3	
4	RETURN
5	
6	- SENSE

Notes:

1. Dimensions shown are in inches.
2. Tolerance = 0.00 \pm 0.02.
0.000 \pm 0.005.
3. Models DC60-1A through DC60-4A differ slightly in component layout. However, all dimensions and pin connectors are the same as shown.

- Over-Voltage Shutdown
- Short-Circuit Protection

APPLICATIONS

- Telecommunications Equipment
- Process Control Systems
- Portable/Battery-Operated Equipment



All DC100 models are open-frame converters in a compact 4.2 x 8.5 x 2.2-inch format.

GENERAL SPECIFICATIONS

DC INPUT VOLTAGE.....	See voltage/current rating chart.
EMI SUPPRESSION.....	Pi input filter.
INPUT LINE PROTECTION.....	External fuse is recommended. (See Note 1.)
INPUT REFLECTED RIPPLE.....	100 mApp (nominal input line, full load).
DC OUTPUT.....	See voltage/current rating chart.
CONTINUOUS OUTPUT POWER.....	See voltage/current rating chart.
OUTPUT VOLTAGE TOLERANCE.....	±1 percent, all outputs.
OVER-VOLTAGE PROTECTION.....	Primary output only: 6.0V - 6.5V.
SHORT-CIRCUIT PROTECTION.....	Standard. All outputs protected against overload with automatic recovery.
SOFT START.....	Standard on all models. Prevents output overshoot and power transformer saturation at turn-on.
NOISE, RIPPLE AND SPIKE.....	See voltage/current rating chart.
LINE/LOAD REGULATION.....	See voltage/current rating chart.
ISOLATION VOLTAGE.....	1500 VDC, input to output for one second.
EXTERNAL SHUTDOWN.....	Control pin: Unit OFF = 1.2V - 5.5V. Unit ON = 0V - 0.6V.
TRANSIENT RESPONSE.....	1 ms for step change of minimum to nominal load on primary with auxiliary outputs at 50 percent of full load.
OPERATING FREQUENCY.....	100 kHz.

ENVIRONMENTAL OPERATING CHARACTERISTICS

TEMPERATURE RANGE.....	0°C to +70°C; derate each output 2 percent/°C from +50°C to +70°C.
TEMPERATURE COEFFICIENT.....	±0.02 percent/°C.
COOLING.....	Convection cooling is adequate. In a confined area, moving air or conduction cooling is recommended.
RELATIVE HUMIDITY.....	0 to 95 percent, non-condensing.
ALTITUDE.....	0 to 10,000 feet.

STORAGE CHARACTERISTICS

TEMPERATURE RANGE.....	-55°C to +100°C.
RELATIVE HUMIDITY.....	0 to 95 percent, non-condensing.

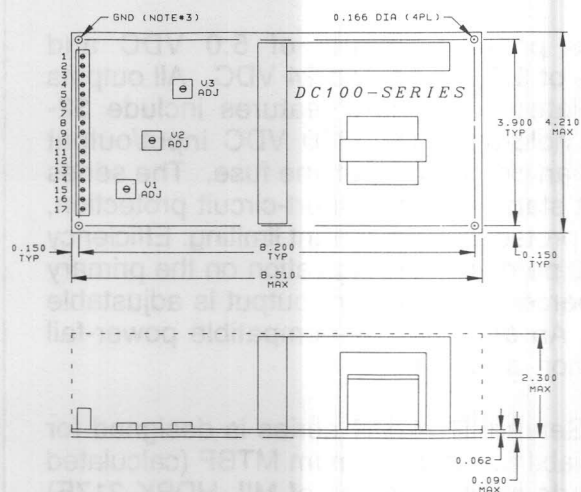
Model Number	DC Input Voltage			Nom. Input Current (A)	Output Voltage				Output Current			Line Reg.	Load Reg.	RMS Noise, Ripple, Spike	Max. Output Power (W)	Efficiency
	Min. (V)	Nom. (V)	Max. (V)		Output	Adj. Min. (V)	Fact. Set (V)	Adj. Max. (V)	Min. (A)	Nom. (A)	Max. (A)					
DC100-1A	10.5	12	18	12.5	V1	—	5.0	—	2.0	8.0	12	±0.5%	±0.5%	1.0%	85	70%
					V2	10	12	16	0.5	4.0	5.0	±1.0%	±1.0%	2.0%		
					V3	10	12	16	0.5	1.0	1.0	±1.0%	±1.0%	2.0%		
DC100-1B	18	24	36	6.3	V1	—	5.0	—	2.0	8.0	12	±0.5%	±0.5%	1.0%	100	80%
					V2	10	12	16	0.5	4.0	5.0	±1.0%	±1.0%	2.0%		
					V3	10	12	16	0.5	1.0	1.0	±1.0%	±1.0%	2.0%		
DC100-1C	36	48	72	3.2	V1	—	5.0	—	2.0	8.0	12	±0.5%	±0.5%	1.0%	100	80%
					V2	10	12	16	0.5	4.0	5.0	±1.0%	±1.0%	2.0%		
					V3	10	12	16	0.5	1.0	1.0	±1.0%	±1.0%	2.0%		
DC100-2A	10.5	12	18	12.5	V1	—	5.0	—	2.0	8.0	12	±0.5%	±0.5%	1.0%	85	70%
					V2	24	24	28	0.5	2.0	3.0	±1.0%	±1.0%	2.0%		
					V3	24	24	28	0.5	1.0	1.0	±1.0%	±1.0%	2.0%		
DC100-2B	18	24	36	6.3	V1	—	5.0	—	2.0	8.0	12	±0.5%	±0.5%	1.0%	100	80%
					V2	24	24	28	0.5	2.0	3.0	±1.0%	±1.0%	2.0%		
					V3	24	24	28	0.5	1.0	1.0	±1.0%	±1.0%	2.0%		
DC100-2C	36	48	72	3.2	V1	—	5.0	—	2.0	8.0	12	±0.5%	±0.5%	1.0%	100	80%
					V2	24	24	28	0.5	2.0	3.0	±1.0%	±1.0%	2.0%		
					V3	24	24	28	0.5	1.0	1.0	±1.0%	±1.0%	2.0%		

Notes:

1. Input line fuse: 12V input models, use 15A /125V slow-blow fuse; 24V input, use 10A /125V slow-blow fuse; 48V input, use 5A /125V slow-blow use.
2. Sum of primary and auxiliary output must not exceed maximum power output rating.
3. All measurements are at nominal input and nominal load and +25°C, unless otherwise specified.
4. Line regulation is measured at nominal load over the full input voltage range.
5. Load regulation is measured at nominal input voltage from minimum load to maximum load.
6. For ripple and spike measurements, the output under test is at full rated current with remaining outputs loaded to 100% of the supply's output power rating
7. Peak-to-peak and RMS metering equipment shall have a 20 MHz response with probes and cables maintaining a frequency response of 20 Hz to 20 MHz. Output ripple and spikes are measured directly at the output terminals of the power supply across a 0.1 μ F ceramic capacitor without use of the probe ground.

PIN-OUT

Pin	All Models
1	+ V IN
2	
3	- V IN
4	
5	+ V3
6	- V3
7	+ V2
8	
9	- V2
10	
11	+ SENSE
12	+ V1
13	
14	- V1
15	
16	- SENSE
17	SHUTDOWN



Notes:

1. Dimensions shown are in inches.
2. Tolerance = 0.00 ±0.02.
0.000 ±0.005.
3. For proper grounding, all ground points should be tied to chassis ground.

DC4-150 SERIES

150W QUAD OUTPUT DC-DC CONVERTERS —WIDE-RANGE DC INPUT, ULTRA-HIGH RELIABILITY—

FEATURES

- 38-64 VDC Input Voltage Range
- 150 Watts Continuous Output Power
- Meets UL1950
- Meets CSA C22.2-234/950
- Meets VDE0805
- Meets EN60950/IEC950
- VDE/FCC Class B Input Line Filter
- 0% Minimum Load on All Outputs
- Over-Current/Short-Circuit Protection
- Minimum 165,000 hours MTBF
- **2-Year Warranty**

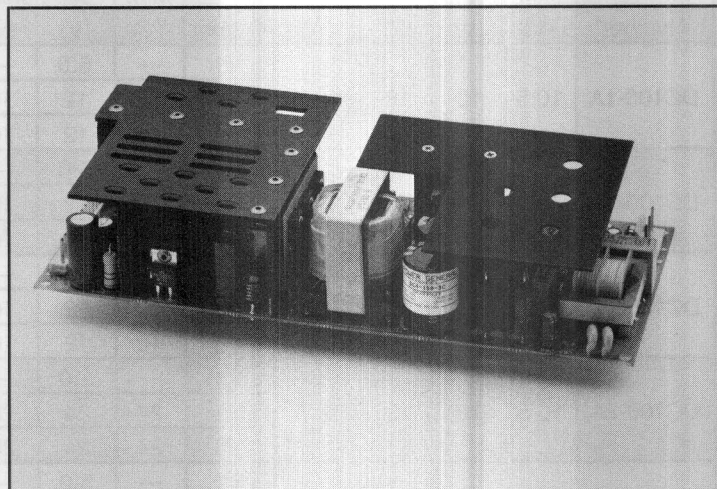
APPLICATIONS

- Data Communications Equipment
- Industrial Control Systems
- Telecommunications Equipment

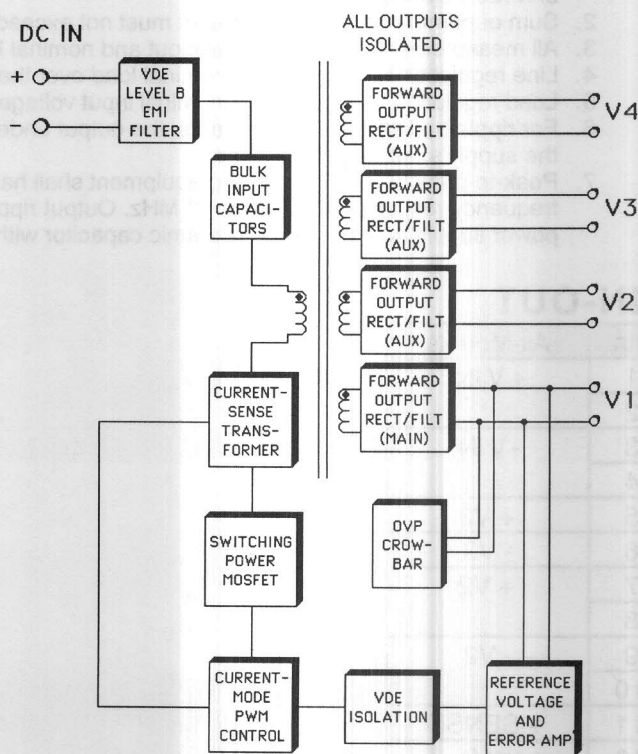
DC4-150 is a series of four-output, 150-watt, open-frame dc-dc converters designed to meet all international safety agency standards, including those of VDE, IEC, UL and CSA. These supplies offer high-performance features such as a 38V-64V input voltage range (48V, nominal), zero percent minimum load requirement for all outputs and an on-board EMI suppression filter that complies to VDE/FCC Class B specifications.

Five models provide outputs of 5.0 VDC and combinations of 5.0, 12, 15 and 24 VDC. All outputs are fully isolated. Standard features include 32-millisecond hold-up time, 5300 VDC input/output isolation and an on-board input line fuse. The series provides soft start, indefinite short-circuit protection, over-voltage protection and current limiting. Efficiency is typically 70 percent; load regulation on the primary output is 1 percent; the primary output is adjustable ± 5 percent. An optional TTL-compatible power-fail warning function is available.

The Power General DC4-150 series is designed for ultra-high reliability. The minimum MTBF (calculated using the "parts stress" method of MIL-HDBK 217E) is 165,000 hours. Operation is specified over the temperature range of 0°C to +70°C with cooling by natural convection. All models are fabricated on a compact 4.0 x 9.5-inch printed circuit board with a maximum component height of 2.0 inches.



FUNCTIONAL BLOCK DIAGRAM



GENERAL SPECIFICATIONS

DC INPUT	38V-64V (48V, nominal).
INPUT LINE PROTECTION	Input line fuses provided on-board.
EMI FILTER	Standard. Exceeds minimum requirements of VDE/FCC Class B by 10 dB, typical.
DC OUTPUT	See voltage/current rating chart.
CONTINUOUS OUTPUT POWER	150 watts, maximum.
OUTPUT VOLTAGE ADJUST	Adjustable $\pm 5\%$, primary output only.
EFFICIENCY	70%, typical. (Nominal input voltage line conditions and full load.)
HOLD-UP TIME	32 ms at 48 VDC.
OVERLOAD PROTECTION	Power-limit circuit.
SHORT-CIRCUIT PROTECTION	Indefinite.
OVER-VOLTAGE PROTECTION	Standard on all models, crowbar type, 120% V_{OUT} , typical.
SOFT START	Standard on all models. Prevents output overshoot and power transformer saturation at turn-on.
DESIGN TOPOLOGY	Forward converter, current-mode control.
FREQUENCY OF OPERATION	50 kHz (fixed).
HI-POT ISOLATION	5300 VDC, input-to-output for one minute. (See Note 1.)
NOISE, RIPPLE & SPIKES	1% peak-to-peak, maximum. (See Note 2.)
TRANSIENT RESPONSE	4 ms recovery to within 1% of regulation band with 5% maximum deviation.
POWER FAIL (OPTIONAL)	TTL-compatible, 4 ms, minimum, before loss of output.

ENVIRONMENTAL OPERATING CHARACTERISTICS

TEMPERATURE RANGE	0°C to +70°C.
OUTPUT POWER DERATING	Derate output power and current linearly 2%/°C from +50°C to +70°C.
TEMPERATURE COEFFICIENT	$\pm 0.05\%/^{\circ}\text{C}$ over the entire operating temperature range.
RELATIVE HUMIDITY	0 to 95%, non-condensing.
ALTITUDE	0 to 10,000 feet.
COOLING	Convection cooling is adequate. When operating in a confined area, moving air is recommended.

STORAGE CHARACTERISTICS

TEMPERATURE RANGE	-40°C to +85°C.
RELATIVE HUMIDITY	0 to 95%, non-condensing.

RELIABILITY

MEAN TIME BETWEEN FAILURES	>165,000 Hours, per MIL-HDBK 217E Parts Stress Method. (Ground benign, +25°C.)
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Notes:

1. Hi-pot isolation is 2200 VDC from input to ground for 60 seconds.
2. Peak-to-peak and RMS metering equipment shall have a 20 MHz frequency response with probes and cables maintaining a frequency response of 20 Hz to 20 MHz. Output ripple and spikes are measured directly at the output terminals of the power supply with a 0.1 μF ceramic capacitor without the use of the probe ground clip.

OUTPUT VOLTAGE

CONSTRUCTION

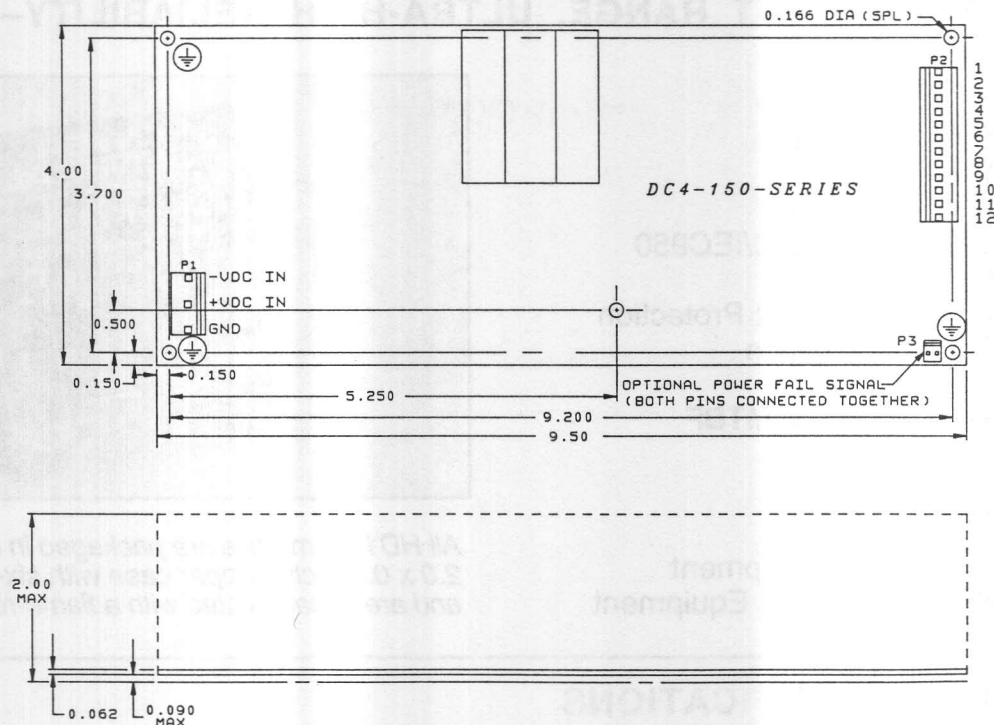
(A = OPEN PCB)

Model Number	Output Voltage		Output Current				Line Reg. (Note 3)	Load Reg. (Note 4)	Cross-Reg. (Note 5)	Error Envelope (Note 6)
	Output	(V)	Min. (A)	Nom. (A)	Max. (A)	Peak (A)				
DC4-150-1	V1	5.0	0.0	10	15	—	0.3%	1.0%	—	1.0%
	V2	12	0.0	2.4	4.0	8.0	0.5%	3.0%	3.0%	6.0%
	V3	12	0.0	2.4	4.0	8.0	0.5%	3.0%	3.0%	6.0%
	V4	5.0	0.0	2.4	4.0	—	0.5%	5.0%	3.0%	6.0%
DC4-150-2	V1	5.0	0.0	10	15	—	0.3%	1.0%	—	1.0%
	V2	12	0.0	2.4	4.0	8.0	0.5%	3.0%	3.0%	6.0%
	V3	12	0.0	2.4	4.0	8.0	0.5%	3.0%	3.0%	6.0%
	V4	12	0.0	3.6	6.0	8.0	0.5%	4.0%	3.0%	6.0%
DC4-150-3	V1	5.0	0.0	10	15	—	0.3%	1.0%	—	1.0%
	V2	12	0.0	2.4	4.0	8.0	0.5%	3.0%	3.0%	6.0%
	V3	12	0.0	2.4	4.0	8.0	0.5%	3.0%	3.0%	6.0%
	V4	15	0.0	2.4	4.0	6.0	0.5%	4.0%	3.0%	6.0%
DC4-150-4	V1	5.0	0.0	10	15	—	0.3%	1.0%	—	1.0%
	V2	12	0.0	2.4	4.0	8.0	0.5%	3.0%	3.0%	6.0%
	V3	12	0.0	2.4	4.0	8.0	0.5%	3.0%	3.0%	6.0%
	V4	24	0.0	1.5	3.0	8.0	0.5%	4.0%	3.0%	6.0%
DC4-150-5	V1	5.0	0.0	10	15	—	0.3%	1.0%	—	1.0%
	V2	15	0.0	1.8	3.0	6.0	0.5%	3.0%	3.0%	6.0%
	V3	15	0.0	1.8	3.0	6.0	0.5%	3.0%	3.0%	6.0%
	V4	5.0	0.0	2.4	4.0	—	0.5%	5.0%	3.0%	6.0%

Notes:

1. All outputs are electrically isolated from each other and may be referenced positive or negative.
2. The 12V, 15V, and 24V outputs will accept pulse load currents for a period of less than 60 seconds.
3. Line regulation is measured under nominal load conditions with the input voltage varied from 38 to 64VDC.
4. Load regulation is measured at 48 VDC input while the output under test is loaded to 60% of nominal load and varied $\pm 40\%$ of nominal load. Other outputs are held at nominal load.
5. Cross-regulation is tested by changing the load on the primary output (V1) from 8A to 12A while measuring the voltage change on the auxiliary output.
6. Error envelope is measured at nominal line conditions. The primary output (V1) is varied from 8A to 12A while auxiliary outputs are varied from 3A to 1.5A.
7. All measurements should be made directly at the terminals of the power supply.
8. Replace the input line fuses with the same type and rating. **Recommended: 7.0A/125VAC slow-blow fuse.**

MECHANICAL OUTLINE AND PIN CONFIGURATION



Notes:

1. Dimensions shown are in inches.
2. Tolerances = 0.00 \pm 0.01 inch.
0.000 \pm 0.005 inch

PIN-OUT

Pin	DC4-150-1	DC4-150-2	DC4-150-3	DC4-150-4	DC4-150-5
1	+V4 (ISO)	+V4 (ISO)	+V4 (ISO)	+V4 (ISO)	+V4 (ISO)
2	-V4 (ISO)	-V4 (ISO)	-V4 (ISO)	-V4 (ISO)	-V4 (ISO)
3	+V3 (ISO)	+V3 (ISO)	+V3 (ISO)	+V3 (ISO)	+V3 (ISO)
4	-V3 (ISO)	-V3 (ISO)	-V3 (ISO)	-V3 (ISO)	-V3 (ISO)
5	-V2 (ISO)	-V2 (ISO)	-V2 (ISO)	-V2 (ISO)	-V2 (ISO)
6	+V2 (ISO)	+V2 (ISO)	+V2 (ISO)	+V2 (ISO)	+V2 (ISO)
7	-V1 (ISO)	-V1 (ISO)	-V1 (ISO)	-V1 (ISO)	-V1 (ISO)
8	(P.F. RTN)	(P.F. RTN)	(P.F. RTN)	(P.F. RTN)	(P.F. RTN)
9					
10					
11	+V1 (ISO)	+V1 (ISO)	+V1 (ISO)	+V1 (ISO)	+V1 (ISO)
12					

CONNECTORS

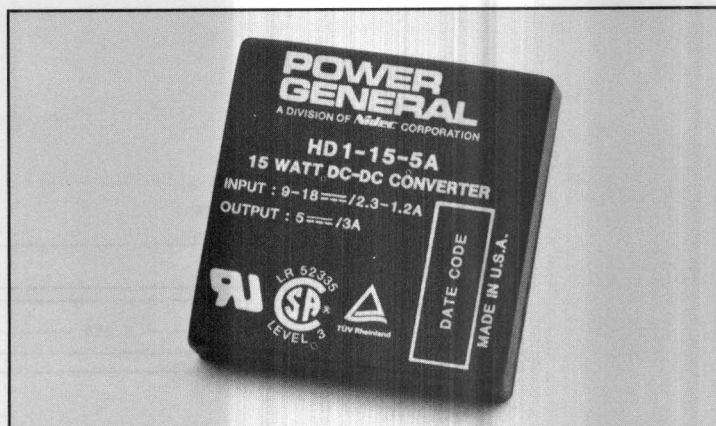
<u>P1 Input Connector</u>			<u>P2 Output Connector</u>	<u>P3 Power-Fail Connector</u>
MOLEX 09-74-1051			MOLEX 09-74-1121	MOLEX 22-23-2021
<u>Pin 1</u>	<u>Pin 2</u>	<u>Pin 3</u>		
- V IN	+ V IN	Ground		
MOLEX Mating Connector			MOLEX Mating Connector	MOLEX Mating Connector
Housing	09-50-1051		Housing	22-01-2027
Crimp Terminal	08-70-1030		Crimp Terminal	16-02-1115

HD1-15 SERIES

15W SINGLE OUTPUT DC-DC CONVERTERS —WIDE INPUT RANGE, ULTRA-HIGH RELIABILITY—

FEATURES

- Wide Input Voltage Range
- Meets UL1950
- Meets CSA22.2-234/950
- Meets VDE0805/EN60950/IEC950
- Pi Input Filter
- Over-Voltage/Short-Circuit Protection
- Tight Line/Load Regulation
- 2-Year Warranty
- **Minimum 300,000 Hours MTBF**



APPLICATIONS

- Telecommunications Equipment
- Portable/Battery-Operated Equipment

All HD1-15 models are packaged in a compact 2.0 x 2.0 x 0.4-inch copper case with six-sided shielding and are encapsulated with a flame-retardant material.

GENERAL SPECIFICATIONS

DC INPUT VOLTAGE	See voltage/current rating chart.
INRUSH CURRENT	15A, peak, 25 μ s.
EMI SUPPRESSION	Pi input filter .
REVERSE VOLTAGE PROTECTION	Internal shunt diode.
DC OUTPUT	See voltage/current rating chart.
CONTINUOUS OUTPUT POWER	15 watts, maximum.
SHORT-CIRCUIT PROTECTION	Indefinite.
EFFICIENCY	75 percent, minimum.
LINE/LOAD REGULATION	See voltage/current rating chart.
ISOLATION VOLTAGE	1500 VDC, input to output, for one minute.
TRANSIENT RESPONSE	500 μ s recovery from half-load to full load step change to within 1 percent of regulation band with 5 percent maximum deviation.
NOISE AND RIPPLE	5.0V output, 50 mV _{pp} , maximum; 12V and 15V outputs, 75 mV _{pp} , maximum.
OPERATING FREQUENCY	150 kHz.

ENVIRONMENTAL OPERATING CHARACTERISTICS

TEMPERATURE RANGE	-25°C to +85°C; derate 3 percent/°C from +70°C to +85°C.
TEMPERATURE COEFFICIENT	\pm 0.02 percent/°C.
COOLING	Free-air convection.
RELATIVE HUMIDITY	0 to 95 percent, non-condensing.
ALTITUDE	0 to 10,000 feet.

STORAGE CHARACTERISTICS

TEMPERATURE RANGE	-55°C to +100°C.
RELATIVE HUMIDITY	0 to 95 percent, non-condensing.

RELIABILITY

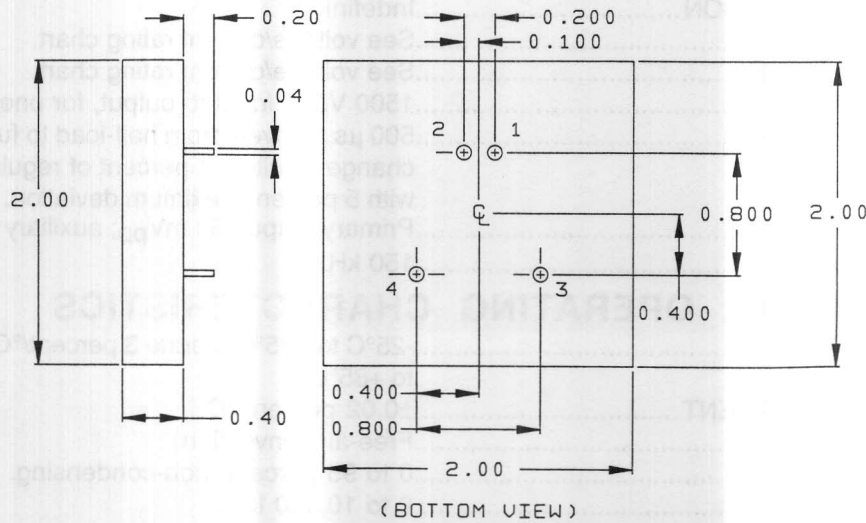
MEAN TIME BETWEEN FAILURES	>300,000 hours, per "Parts Stress" method in MIL-HDBK 217E (ground benign, 25°C).
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Model Number	DC Input Voltage			Nom. Input Current (A)	Output Voltage (V)	Output Current			Output Voltage Tolerance	Line Reg. (LL-HL)	Load Reg. (NL-FL)
	Min. (V)	Nom. (V)	Max. (V)			Min. (A)	Nom. (A)	Max. (A)			
HD1-15-5A	9.0	12	18	1.7	5.0	0.00	2.50	3.00	±1.0%	±0.3%	±0.5%
HD1-15-5B	18	24	36	0.8	5.0	0.00	2.50	3.00	±1.0%	±0.3%	±0.5%
HD1-15-5C	36	48	72	0.4	5.0	0.00	2.50	3.00	±1.0%	±0.3%	±0.5%
HD1-15-12A	9.0	12	18	1.7	12	0.00	1.00	1.25	±1.0%	±0.3%	±0.5%
HD1-15-12B	18	24	36	0.8	12	0.00	1.00	1.25	±1.0%	±0.3%	±0.5%
HD1-15-12C	36	48	72	0.4	12	0.00	1.00	1.25	±1.0%	±0.3%	±0.5%
HD1-15-15A	9.0	12	18	1.7	15	0.00	0.75	1.00	±1.0%	±0.3%	±0.5%
HD1-15-15B	18	24	36	0.8	15	0.00	0.75	1.00	±1.0%	±0.3%	±0.5%
HD1-15-15C	36	48	72	0.4	15	0.00	0.75	1.00	±1.0%	±0.3%	±0.5%

Notes:

1. All measurements are at nominal input and nominal load and +25°C, unless otherwise specified.
2. Input current is measured at nominal input voltage, full load and +25°C.
3. External line fuse is recommended: For models with 12V input, use 4.0A/125V fuse. For models with 24V input, use 2.0A/125V fuse. For models with 48V input, use 1.0A/125V fuse.
4. Peak-to-peak and RMS metering equipment shall have a 20 MHz response with probes and cables maintaining a frequency response of 20 Hz to 20 MHz. Output ripple and spikes are measured directly at the output terminals of the power supply across a 0.1 μ F ceramic capacitor without use of the probe ground.

MECHANICAL OUTLINE AND PIN CONFIGURATION



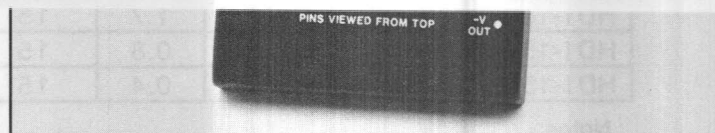
PIN-OUT

Pin	Designation
1	+ V IN
2	- V IN
3	+ V OUT
4	- V OUT

Notes:

1. Dimensions shown are in inches.
2. Tolerance = 0.00 ±0.01.
0.000 ±0.005.

- Remote Output Voltage Adjust
- 2-Year Warranty
- **Minimum 400,000 Hours MTBF**



APPLICATIONS

- Telecommunications Equipment
- Portable/Battery-Operated Equipment

All HD3-25 models are packaged in a compact 3.0 x 3.0 x 0.5-inch copper case with six-sided shielding and are encapsulated with a flame-retardant material.

GENERAL SPECIFICATIONS

DC INPUT VOLTAGE (NOMINAL)	12V, 24V or 48V.
INRUSH CURRENT	25A, peak, 25 μ s.
EMI SUPPRESSION	Pi input filter.
REVERSE VOLTAGE PROTECTION	Internal shunt diode.
REFLECTED RIPPLE CURRENT	50 mApp, maximum.
DC OUTPUT	See voltage/current rating chart.
CONTINUOUS OUTPUT POWER	25 watts, maximum.
OVER-VOLTAGE PROTECTION	Primary output only, \sim 6.8V.
SHORT-CIRCUIT PROTECTION	Indefinite.
EFFICIENCY	See voltage/current rating chart.
LINE/LOAD REGULATION	See voltage/current rating chart.
ISOLATION VOLTAGE	1500 VDC, input to output, for one minute.
TRANSIENT RESPONSE	500 μ s recovery from half-load to full load step change to within 1 percent of regulation band with 5 percent maximum deviation.
NOISE AND RIPPLE	Primary output, 50 mVpp; auxiliary outputs, 75 mVpp.
OPERATING FREQUENCY	150 kHz.

ENVIRONMENTAL OPERATING CHARACTERISTICS

TEMPERATURE RANGE	-25°C to +85°C; derate 3 percent/°C from +70°C to +85°C.
TEMPERATURE COEFFICIENT	\pm 0.02 percent/°C.
COOLING	Free-air convection.
RELATIVE HUMIDITY	0 to 95 percent, non-condensing.
ALTITUDE	0 to 10,000 feet.

STORAGE CHARACTERISTICS

TEMPERATURE RANGE	-55°C to +100°C.
RELATIVE HUMIDITY	0 to 95 percent, non-condensing.

RELIABILITY

MEAN TIME BETWEEN FAILURES	>400,000 hours, per "Parts Stress" method in MIL-HDBK 217E (ground benign, 25°C).
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Model Number	DC Input Voltage			Nom. Input Current (A)	Output Voltage		Output Current			Output Voltage Tolerance	Line Reg. (LL-HL)	Load Reg. (NL-FL)	Error Band	Efficiency
	Min. (V)	Nom. (V)	Max. (V)				Min. (A)	Nom. (A)	Max. (A)					
	Output	(V)												
HD3-25-1A	9.0	12	18	2.8	V1	5.0	0.50	3.00	5.00	±1.0%	±0.3%	±0.5%	±1.0%	75%
					V2	+12	0.05	0.40	0.50	±3.0%	±0.5%	±3.0%	±5.0%	
					V3	-12	0.05	0.40	0.50	±3.0%	±0.5%	±3.0%	±5.0%	
HD3-25-1B	18	24	36	1.4	V1	5.0	0.50	3.00	5.00	±1.0%	±0.3%	±0.5%	±1.0%	80%
					V2	+12	0.05	0.40	0.50	±3.0%	±0.5%	±3.0%	±5.0%	
					V3	-12	0.05	0.40	0.50	±3.0%	±0.5%	±3.0%	±5.0%	
HD3-25-1C	36	48	72	0.7	V1	5.0	0.50	3.00	5.00	±1.0%	±0.3%	±0.5%	±1.0%	82%
					V2	+12	0.05	0.40	0.50	±3.0%	±0.5%	±3.0%	±5.0%	
					V3	-12	0.05	0.40	0.50	±3.0%	±0.5%	±3.0%	±5.0%	
HD3-25-2A	9.0	12	18	2.8	V1	5.0	0.50	3.00	5.00	±1.0%	±0.3%	±0.5%	±1.0%	75%
					V2	+15	0.05	0.33	0.50	±3.0%	±0.5%	±3.0%	±5.0%	
					V3	-15	0.05	0.33	0.50	±3.0%	±0.5%	±3.0%	±5.0%	
HD3-25-2B	18	24	36	1.4	V1	5.0	0.50	3.00	5.00	±1.0%	±0.3%	±0.5%	±1.0%	80%
					V2	+15	0.05	0.33	0.50	±3.0%	±0.5%	±3.0%	±5.0%	
					V3	-15	0.05	0.33	0.50	±3.0%	±0.5%	±3.0%	±5.0%	
HD3-25-2C	36	48	72	0.7	V1	5.0	0.50	3.00	5.00	±1.0%	±0.3%	±0.5%	±1.0%	82%
					V2	+15	0.05	0.33	0.50	±3.0%	±0.5%	±3.0%	±5.0%	
					V3	-15	0.05	0.33	0.50	±3.0%	±0.5%	±3.0%	±5.0%	

Notes:

1. External input line fuse is recommended: for 12V input, use 5A /125V fuse; for 24V input, use 2A /125V fuse; for 48V input, use 1A /125V fuse.
2. Sum of primary and auxiliary output must not exceed 25W maximum power output rating of the supply.
3. All measurements are at nominal input voltage, nominal load and +25°C, unless otherwise specified.
4. Line regulation is measured at nominal load over the full input voltage range.
5. Auxiliary output load regulation is measured with the primary output at +5.0V/3.0A as auxiliary output is changed from minimum to nominal value.
6. Error band is defined as static output regulation at +25°C, the sum of initial set point accuracy, line voltage within specified limits, and load currents within specified limits.

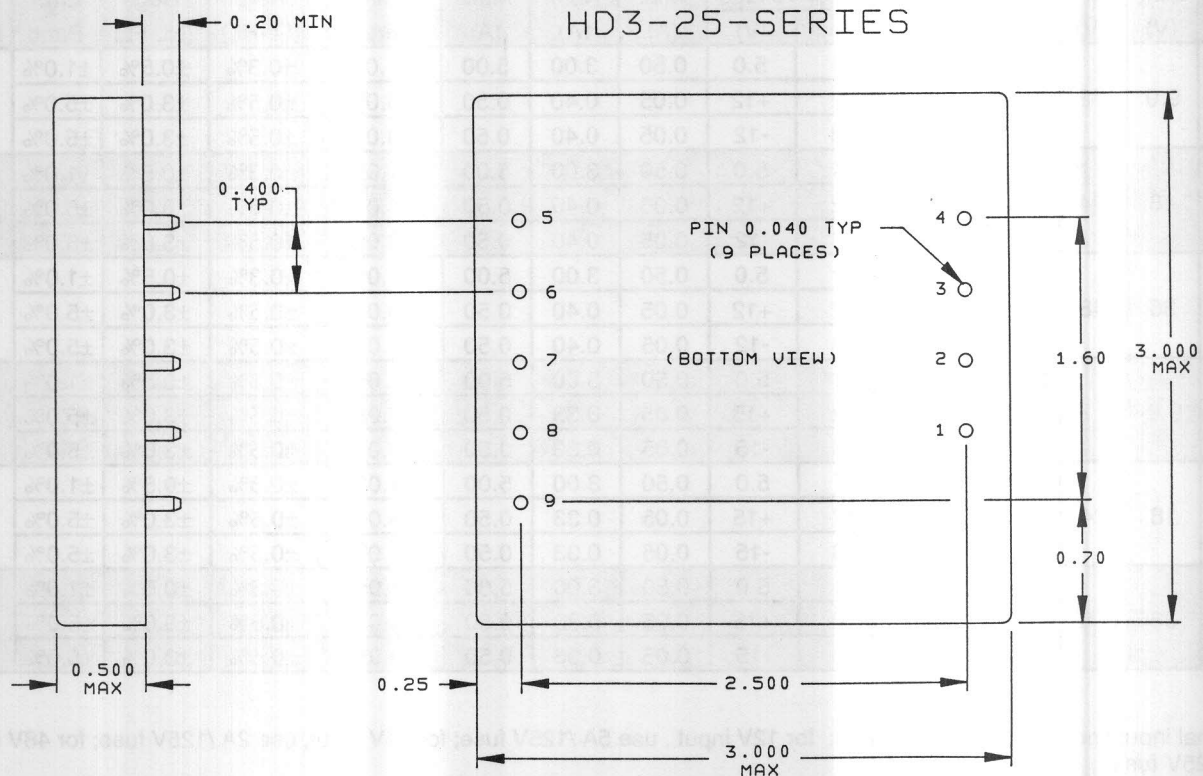
Series HD3-25 dc-dc converters are also available with tightly regulated auxiliary outputs. For information, contact Power General.

REMOTE ON/OFF CONTROL

LOGIC COMPATIBILITYOpen-collector TTL or CMOS.
 ON CONTROL INPUT VOLTAGE.....Open circuit.
 OFF CONTROL INPUT VOLTAGE.....<0.8V.
 CONTROL COMMON.....Reference to MINUS power supply input

HD3-25 SERIES

MECHANICAL OUTLINE AND PIN CONFIGURATION



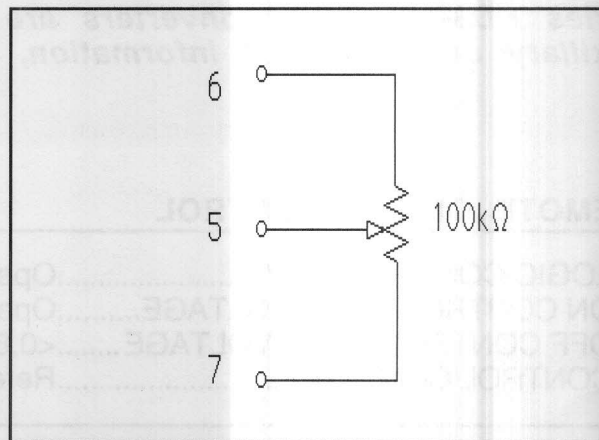
Notes:

1. Dimensions shown are in inches.
2. Tolerance = 0.00 \pm 0.01.
0.000 \pm 0.005.

PIN-OUT

Pin	12V and 24V Input	48V Input
1	+ V IN	- V IN
2	- V IN	+ V IN
3	CASE	CASE
4	SHUTDOWN	SHUTDOWN
5	OUT ADJUST	OUT ADJUST
6	V1	V1
7	COMMON	COMMON
8	V2	V2
9	V3	V3

OUTPUT ADJUSTMENT



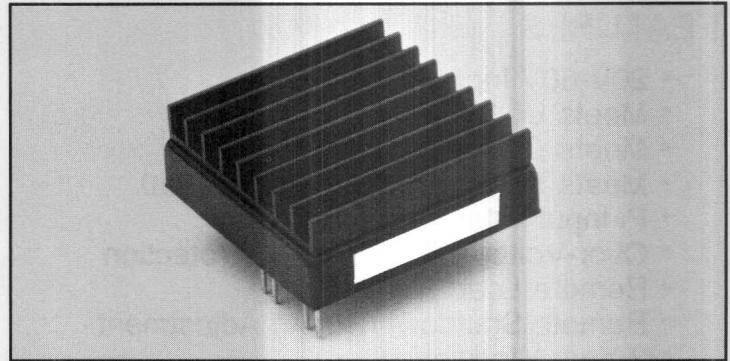
24-33W SINGLE OUTPUT DC-DC CONVERTERS —USER-SELECTED OUTPUT, HIGH RELIABILITY—

FEATURES

- Trim-Chosen Output
33W Output at 3.3V
24W Output at 2.0V
- Pi Input Filter
- Short-Circuit Protection
- Remote Shutdown
- 2-Year Warranty
- **Minimum 200,000 Hours MTBF**

APPLICATIONS

- 3.3V Logic
- GaAs Logic

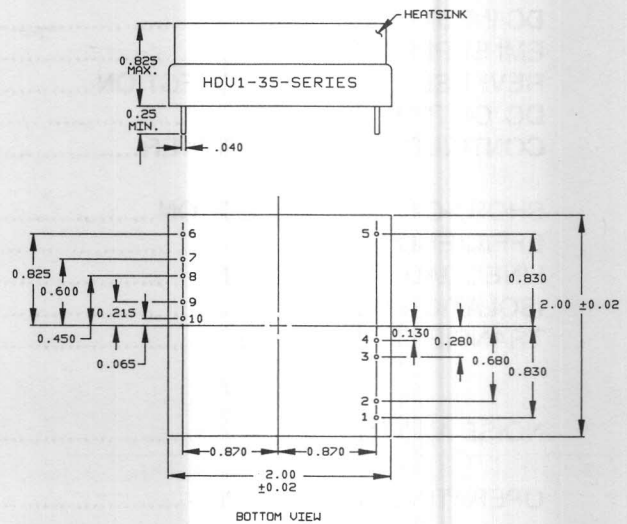


HDU1-35 is supplied in a compact 2.0 x 2.0 x 0.825-inch package with a copper case, six-sided shielding and a top-mounted heat sink.

Model Number	DC Input Voltage			Nom. Input Current (A)	Output Voltage (Note 1) (V)	Output Current		Output Voltage Tolerance	Line Reg. (LL-HL)	Load Reg. (NL-FL)
	Min. (V)	Nom. (V)	Max. (V)			Min. (A)	Max. (A)			
HDU1-35-5-2/3.3	4.75	5.00	5.50	6.9	2.0	0	12	±5.0%	1.0%	1.0%
				8.2	3.3	0	10	±5.0%	1.0%	1.0%

Notes:

1. Output selection: Pin 6 tied to Pin 9 or Pin 10, $V_{OUT} = 3.3V$; Pin 6 open, $V_{OUT} = 2.0V$.
2. External line fuse is recommended: Use 10A/125V slow-blow fuse.
3. Peak-to-peak and RMS measuring equipment shall have a 20 MHz response with probes and cables maintaining a frequency response of 20 Hz to 20 MHz. Output ripple and spikes are measured directly at the output terminals of the power supply across a 0.1 μF ceramic capacitor without use of the probe ground.
4. Dimensions shown are in inches.
5. Dimension tolerance = 0.00 ±0.01.
0.000 ±0.005.



GENERAL SPECIFICATIONS

DC INPUT VOLTAGE.....5.0V -5/+10 percent.
EMI SUPPRESSIONPi input filter.
REVERSE VOLTAGE PROTECTION ..Internal shunt diode.
CONTINUOUS OUTPUT POWER33 watts at 3.3V output,
24W at 2.0V output with
maximum base-plate
operating temperature
of +85°C.
EFFICIENCY80 percent, typical.
LINE/LOAD REGULATION1 percent, maximum.
NOISE AND RIPPLE100 mV_{pp}, maximum.
OPERATING FREQUENCY.....200 kHz.

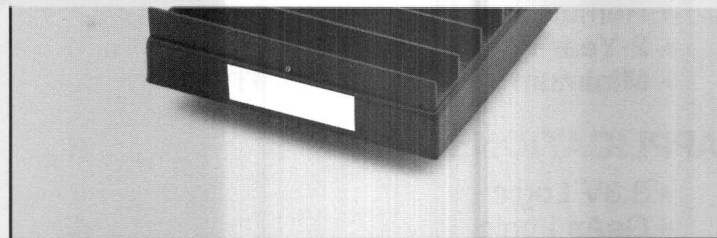
RELIABILITY

MEAN TIME BETWEEN FAILURES.....>200,000 hours, per
"Parts Stress" method
in MIL-HDBK 217E
(ground benign, 25°C).

PIN-OUT

Pin	Designation
1	+ V IN
2	
3	- V IN
4	
5	SHUTDOWN
6	TRIM
7	+ V OUT
8	
9	- V OUT
10	

- Over-Voltage/Short-Circuit Protection
- Remote Load Sensing
- Remote Shutdown/Output Adjustment
- 2-Year Warranty
- **Minimum 200,000 Hours MTBF**



APPLICATIONS

- Distributed Power Systems
- Telecommunications Equipment
- Portable/Battery-Operated Equipment

All HD1-40 models are supplied in a compact 3.0 x 3.0 x 0.88-inch package with a copper case, six-sided shielding, and a top-mounted heat sink

GENERAL SPECIFICATIONS

DC INPUT VOLTAGE	See voltage/current rating chart.
EMI SUPPRESSION	Pi input filter.
REVERSE VOLTAGE PROTECTION	Internal shunt diode.
DC OUTPUT	See voltage/current rating chart.
CONTINUOUS OUTPUT POWER	40 watts maximum with <i>maximum</i> base-plate operating temperature of +85°C.
SHORT-CIRCUIT PROTECTION	Indefinite.
EFFICIENCY	75 percent, minimum.
LINE/LOAD REGULATION	See voltage/current rating chart.
ISOLATION VOLTAGE	1500 VDC, input to output, for one minute.
TRANSIENT RESPONSE	500 μ s recovery from half-load to full load step change to within 1 percent of regulation band with 5 percent maximum deviation.
NOISE AND RIPPLE	5.0V output, 50 mV _{pp} , maximum; 12V and 15V outputs, 75 mV _{pp} , maximum.
OPERATING FREQUENCY	300 kHz.

ENVIRONMENTAL OPERATING CHARACTERISTICS

OPERATING TEMPERATURE RANGE	-25°C to +85°C. See <i>Continuous Output Power</i> , above.
TEMPERATURE COEFFICIENT	± 0.02 percent/°C.
RELATIVE HUMIDITY	0 to 95 percent, non-condensing.
ALTITUDE	0 to 10,000 feet.

STORAGE CHARACTERISTICS

TEMPERATURE RANGE	-55°C to +100°C.
RELATIVE HUMIDITY	0 to 95 percent, non-condensing.

RELIABILITY

MEAN TIME BETWEEN FAILURES	>200,000 hours, per "Parts Stress" method in MIL-HDBK 217E (ground benign, 25°C).
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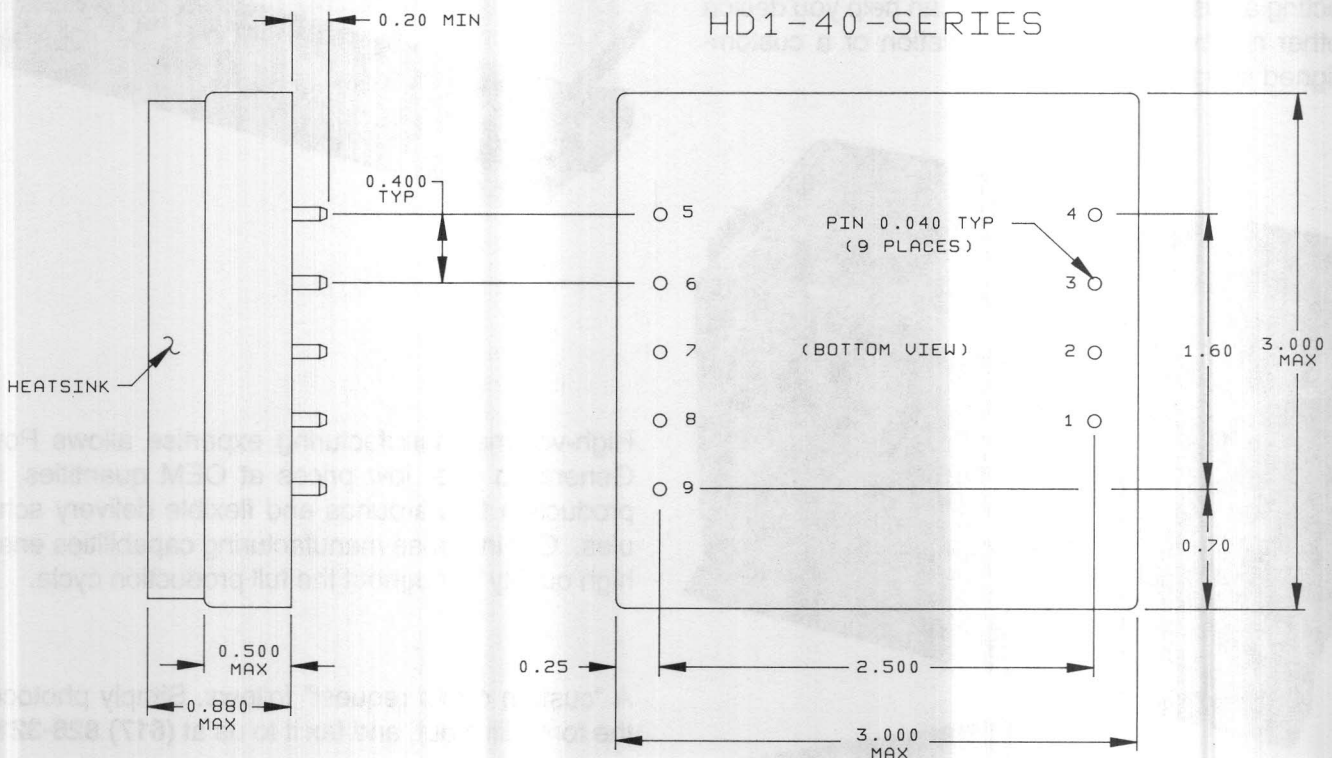
Model Number	DC Input Voltage			Nom. Input Current (A)	Output Voltage (V)	Output Current		Output Voltage Tolerance	Line Reg. (LL-HL)	Load Reg. (NL-FL)
	Min. (V)	Nom. (V)	Max. (V)			Min. (A)	Max. (A)			
HD1-40-5C	20	36	60	1.4	5.0	0.0	8.0	±1.0%	0.3%	0.5%
HD1-40-12C	20	36	60	1.4	12	0.0	3.5	±1.0%	0.3%	0.5%
HD1-40-15C	20	36	60	1.4	15	0.0	3.0	±1.0%	0.3%	0.5%

Notes:

1. All measurements are at nominal input and nominal load and +25°C, unless otherwise specified.
2. Input current is measured at nominal input voltage, full load and +25°C.
3. External line fuse is recommended: Use 3A/125V slow-blow fuse.
4. Peak-to-peak and RMS metering equipment shall have a 20 MHz response with probes and cables maintaining a frequency response of 20 Hz to 20 MHz. Output ripple and spikes are measured directly at the output terminals of the power supply across a 0.1 μ F ceramic capacitor without use of the probe ground.

MECHANICAL OUTLINE AND PIN CONFIGURATION

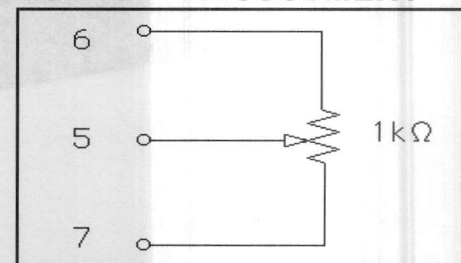
HD1-40-SERIES



PIN-OUT

Pin	Designation
1	- V IN
2	+ V IN
3	CASE
4	SHUTDOWN
5	OUT ADJUST
6	+ V OUT
7	- V OUT
8	+ SENSE
9	- SENSE

OUTPUT ADJUSTMENT



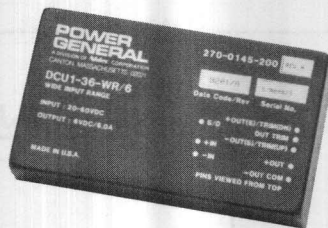
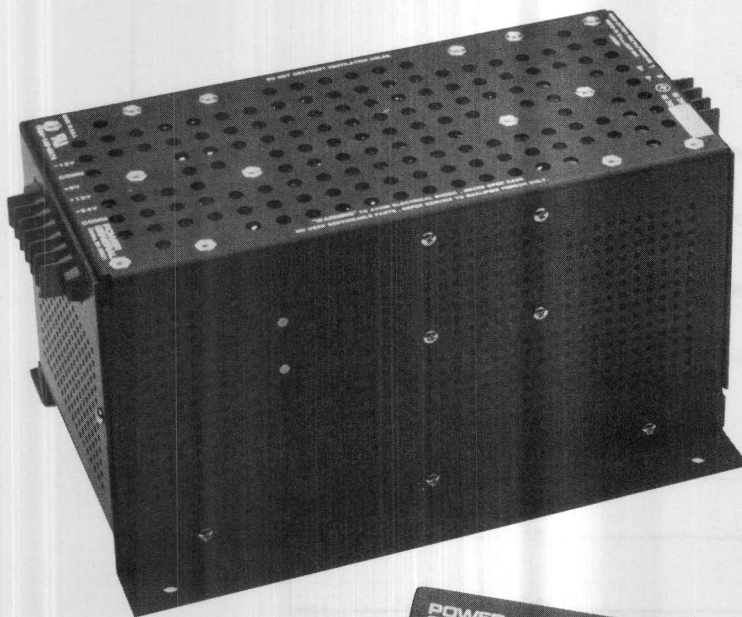
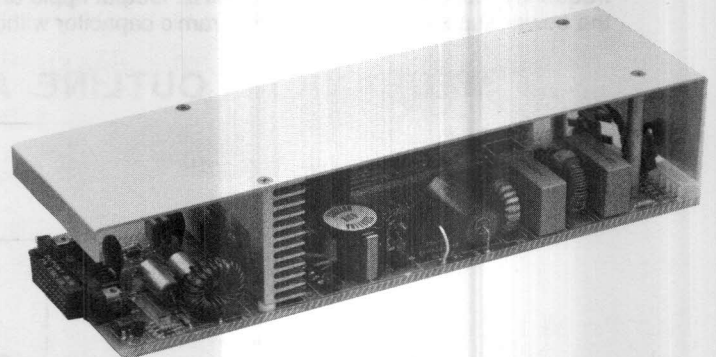
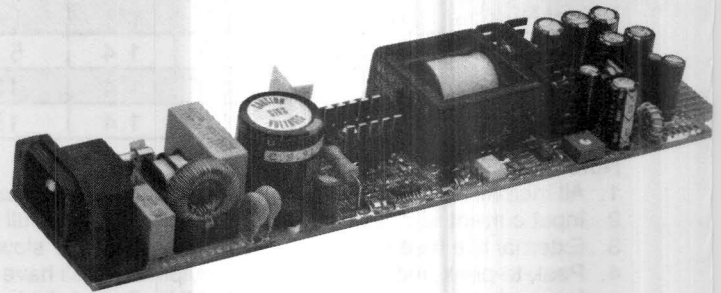
Notes:

1. Dimensions shown are in inches.
2. Tolerance = 0.00 ±0.01.
0.000 ±0.005.

CUSTOM AND MODIFIED PRODUCTS

Equipment designers often need a power supply with special mechanical configurations or electrical characteristics. Power General welcomes opportunities to quote on your custom or modified standard power supply requirements.

Power General's design engineers and its highly skilled applications engineering staff are trained to guide you through a multitude of technical issues encountered in selecting a custom product. They can help you decide whether a simple product modification or a custom-designed supply is required.



High-volume manufacturing expertise allows Power General to offer low prices at OEM quantities, fast production turn-arounds and flexible delivery schedules. Our in-house manufacturing capabilities ensure high quality throughout the full production cycle.

A "custom quote request" follows. Simply photocopy the form, fill it out, and fax it to us at **(617) 828-3215**.